Vol. 8, No. 16
August 31, 1983

# Energy Research Abstracts

Abstracts 38335-39906

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

# CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Telephone (615) 576-1303; (FTS) 626-1303.

## PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

*Energy Abstracts for Policy Analysis (EAPA)*

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

*Energy Research Abstracts (ERA)*

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

The following publications are available to the public on a subscription basis from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic subscribers and $150.00 for subscribers outside the North American continent, except as listed below for *DOE Patents Available for Licensing (PAL)*. A single issue is $7.00 (domestic) and $14.00 (outside the North American continent).

*Current Energy Patents (CEP)*

A monthly publication providing abstracting and indexing coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization. Available as PB83-902800.

*DOE Patents Available for Licensing (PAL)*

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage to this literature. Available as PB83-946800; the annual subscription price is $14.00 (domestic) and $28.00 (foreign).

*Energy and the Environment (EAE)*

A monthly abstract journal devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment. Available as PB83-914900.

*Fossil Energy Update (FEU)*

A monthly abstract journal devoted to information on the processing and use of fossil fuels. Available as PB83-914600.

*Fusion Energy Update (CFU)*

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB83-915300.

*Solar Energy Update (SEU)*

A monthly abstract journal devoted to information on the utilization of solar energy, including biomass and tidal and wind power. Available as PB83-914500.

The following publications are available from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual rate for one volume (calendar) year (24 issues) is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent.

*Direct Energy Conversion (DEC)*

A semimonthly current awareness bulletin covering the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells. Available as PB83-946600.

*Geothermal Energy Technology (GET)*

A semimonthly current awareness bulletin devoted to information on the exploration and development of geothermal resources. Available as PB83-914700.

*Nuclear Fuel Cycle (NFC)*

A semimonthly current awareness bulletin covering all aspects of the nuclear fuel cycle, both front end and back end. Available as PB83-913400.

*Nuclear Reactor Safety (NRS)*

A semimonthly current awareness bulletin covering the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures. Available as PB83-913500.

*Radioactive Waste Management (RWM)*

A semimonthly current awareness bulletin covering the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers. Available as PB83-902900.

## INTERNATIONAL ENERGY PUBLICATIONS

The Technical Information Center cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts*. In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U.S. information for input into the respective journal.

*Atomindex*

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

*Biomass Abstracts*

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

*Coal Abstracts*

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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# ENERGY RESEARCH ABSTRACTS

## ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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## ABOUT *ENERGY RESEARCH ABSTRACTS*

*Energy Research Abstracts (ERA)* provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

*ERA* is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

*ERA* is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

*ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37830.

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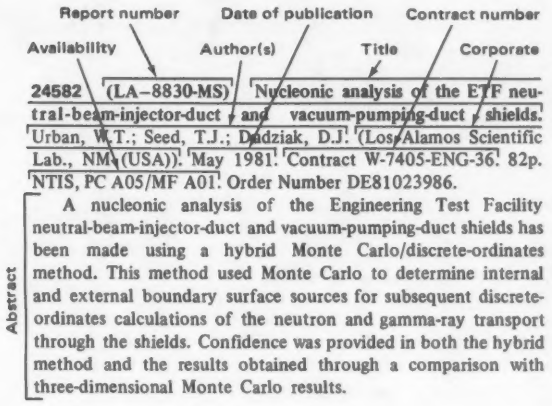
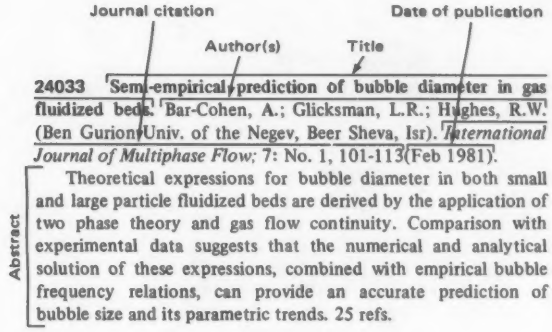
**P. O. Box 62, Oak Ridge, Tennessee 37830**

# HOW TO USE *ENERGY RESEARCH ABSTRACTS*

## ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Contract number
Availability
Author(s)
Title
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.
Abstract
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Abstract
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

## INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

### • Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

**Los Alamos Scientific Lab., NM (USA)**
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

### • Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

**Bar-Cohen, A.,** Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
**Dudziak, D.J.,** *See* Urban, W.T., 6:24582
**Glicksman, L.R.,** *See* Bar-Cohen, A., 7:24033
**Hughes, R.W.,** *See* Bar-Cohen, A., 7:24033
**Seed, T.J.,** *See* Urban, W.T., 6:24582
**Urban, W.T.,** Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

### • Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

**TOKAMAK ETF**
**Neutral Atom Beam Injection**
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)
**Neutron Transport**
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

### • Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

| | | |
|---|---|---|
| **W-7405-ENG-36** | **Los Alamos National Lab., NM (USA)** | |
| | 6:24582 | LA–8830-MS |

### • Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

| | | |
|---|---|---|
| **LA–** | | |
| **8830-MS** | 6:24582 | NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d |

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Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts*, Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

# SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.


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Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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# ENERGY RESEARCH ABSTRACTS

## 01 COAL AND COAL PRODUCTS

*REFER ALSO TO CITATION(S) 38987*

**38335 (BEOP—17) The National Coal Research Programme. Paper presented at the KIvI-symposium 'Developments on fluidized bed combustion in the Netherlands' (7th October, 1982).** van der Klein, C.A.M.; Sens, P.F. (Stichting Energieonderzoek Centrum Nederland, Petten. Bureau Energie Onderzoek). Jan 1983. 24p. (CONF-8210152—1). Stichting Energieonderzoek Centrum Nederland, Petten.

From KIvI symposium on developments on fluidized bed combustion in the Netherlands; Petten, Netherlands (7 Oct 1982).

This paper describes the general objectives of the NOK and it presents the state of the art of the research and development part of the program, comprising about 100 research projects.

**38336 (ORNL—5955) Fossil Energy Program. Quarterly progress report, March 31, 1983.** (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 239p. NTIS, PC A11/MF A01. Order Number DE83013129.

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This quarterly report covers the progress made during the period January 1 through March 31 for the Oak Ridge National Laboratory research and development projects that are carried out in support of the increased utilization of coal and other fossil fuels as sources of clean energy. These projects are supported by various parts of DOE including Fossil Energy, Basic Energy Sciences, Office of Health and Environmental Research, Office of Environmental Compliance and Overview, the Electric Power Research Institute, and by the Tennessee Valley Authority and the EPA Office of Research and Development through inter-agency agreements with DOE.

### 0104 Processing

*REFER ALSO TO CITATION(S) 38367, 38368, 38371, 38378, 38379, 38379, 38427, 38427, 38430, 38452, 38584, 38586, 38587, 39019, 39020, 39022, 39023, 39024*

**38337 (CSS/CI—83-07) Entrained-coal-flow gasification studies in low-oxygen atmospheres.** Chigier, N.A.; Okpala, K.O.; Green, A.R. (Sheffield Univ. (UK); Health and Safety Executive, London (UK)). 1983. 26p. (CONF-830358—13). Carnegie-Mellon Univ., Dept. of Mechanical Engineering, Pittsburgh, PA 15213.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

This paper presents the results obtained in a study of gaseous hydrocarbon yields in an entrained flow reactor. The effects of residence time, particle loading, gas temperature and low oxygen concentration on gaseous hydrocarbon yield were investigated by detailed measurement of the concentrations of stable gas species using probes at various radial and axial locations down-stream of the coal injector. The collected char was also analyzed. Results show that under inert conditions, hydrocarbon yields (the ratio of dry ash-free coal converted to hydrocarbon gas to the total dry ash-free coal fed into the reactor) decreased with increasing particle loading. Addition of small amounts of oxygen (O/C<1.3) to the vitiated air stream significantly improved hydrocarbon yields. The improvement in yield is thought to be due to a reduction in particle agglomeration and to reduction of secondary capture of released or cracked volatiles. Measured weight loss showed a linear relation with gaseous hydrocarbon yield up to 0.04 atm.$0_b$ partial pressure. Up to 13% by weight of the dry ash-free coal was evolved as gaseous hydrocarbon. Evolved gaseous hydrocarbon was successfully correlated by the expression V/sub h/ = x/sub h/(f/sub u ⊃/ +0.78$P_2$/sub O//sup 0.25/)(1-exp(-k/sub h/.t.exp(-E/sub h/RT/ sub m/))). Values for the rate constant, k/sub ho/, and the activation energy, E/sub h/, obtained from a first order rate expression ranged from 0.4 to 4.9 x $10^8 s^{-1}$ and 14.1 to 18.62 kcal/mole respectively for an oxygen partial pressure of 0 to 0.07 atm. Another important conclusion from this study is that entrained flow gasification can be successfully operated with a highly caking coal. 8 figures, 2 tables.

**38338 (DOE/ER/10340—T1) Superacid catalyzed depolymerization and conversion of coals. Final technical report.** Olah, G. (University of Southern California, Los Angeles (USA)). 1980. Contract AT03-79ER10340. 7p. NTIS, PC A02/MF A01. Order Number DE83013036.

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We were interested in applying superacid catalyzed cleavage-depolymerization and ionic hydrogenation low temperature conversion of coal to liquid hydrocarbon, as well as obtaining information about the reactions involved and the structure of intermediates of the coal liquefaction process. In order to show the feasibility of our proposed research we have carried out preliminary investigation in these areas. Preceding our work there was no practical application of a superacid system to coal liquefaction. We carried out an extensive study of the potential of the $HF:BF_3/H_2$ system for coal hydroliquefaction. Under varying conditions of reactant ratio, reaction time and temperature, we were able to obtain over 95% pyridine extractible product by treating coal in $HF:BF_3:H_2$ system at ~ 100°C for 4 hours. The coal to acid ratio was 1:5 and $FB_3$ at 900 psi and $H_2$ at 500 psi were used. These are extremely encouraging results in that the conditions used are drastically milder than those used in any known process, such as Exxon donor solvent and related processes. The cyclohexane extractibility of the treated coal was as high as 27% and the yield of liquid distillate at 400°C/5 x $10^{-3}$/sup torr/ was ~ 30%. The infrared spectrum of product coal, extracts and distillates were distinctly different from the starting coal and show a significant increase in the amount of saturates. The $^1H$ NMR spectrum of cyclohexane extract of the treated coal shows essentially all aliphatic photons. The spectra of other treated coal extracts show increased amounts and types of aliphatic protons as well as significant amounts of protons bound to unsaturated sites. This again indicattes that the $HF-BF_3$ system is depolymerizing the coal to small fragments which are soluble in non-polar solvents.

**38339 (DOE/ET/10255—2, pp I.59-I.146) Calculation of distillable-coal-fluid thermophysical properties using multiparameter corresponding-states correlations.** Starling, K.E.; Brule, M.R.; Lin, C.T.; Watanasiri, S. (Univ. of Oklahoma, Norman). Jul 1981. NTIS, PC A10/MF A01.

In Preparation of a coal conversion systems technical data book. Quarterly report, May 1-July 31, 1980.

Application of multiparameter corresponding-states correlations for predicting the thermophysical properties of coal-derived fluids has been investigated. Convenient graphs and rapid calculation procedures are presented for engineering use. A three-parameter equation of state and transport-property correlations are offered to provide the physical-properties information needed to design separation, heat-exchange, and other unit operations in coal-liquefaction plants. Calculation results are compared with other three-parameter correlations. The information presented in this report should be useful for coal-conversion-industry use for systems that are not highly polar and for which most of the constituents are distillable. Methodologies are presently evolving for handling the more polar systems and systems containing high concentrations of

nondistillable residuum. Thus, the methods presented herein will be improved upon, hopefully in the near future. Another area that will be improved in the future is the correlation of characterization parameters (critical constants, etc.) for pseudocomponent fractions as functions of measureable quantities (boiling temperature, specific gravity, etc.).

**38340 (DOE/ET/14700—14) Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal-liquid and hydrogenation of CO to produce fuels. Quarterly progress report, January-March 1983.** Wiser, W.H. (Utah Univ., Salt Lake City (USA). Dept. of Mining and Fuels Engineering). Apr 1983. Contract AC22-79ET14700. 94p. NTIS, PC A05/MF A01. Order Number DE83011316.

Stereochemical studies of naphthalene hydrogenation over several sulfided CoMo, NiMo and NiW catalysts have revealed unusually high trans/cis ratios in the decalin products. This result is quite different from the low ratios reported for hydrogenation over metal catalysts, and indicates a different site geometry for sulfided catalysts. The active site may consist of a cavity into which the molecule adsorbs, the hydrogen atoms being added from opposite sites, in contrast to the flat adsorption proposed for metal sites. It has been previously shown that at room temperature restrictive diffusion can significantly lower the effectiveness factor of a catalyst when the molecular size of the diffusion molecule is an appreciable fraction of the pore size of the catalyst. New results show that this restrictive diffusion effect decreases with increasing temperature, but may still be important under hydroprocessing conditions.

**38341 (DOE/ET/14880—T3) Kinetics and mechanism of catalytic hydroprocessing of components of coal-derived liquids. Fifteenth quarterly report, November 16, 1982-February 15, 1983.** Gates, B.C.; Kwart, H.; Olson, J.H.; Schuit, G.C.A.; Stiles, A.B.; Petrakis, L. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering; Gulf Research and Development Co., Pittsburgh, PA (USA)). 1 Apr 1983. Contract AC22-79ET14880. 34p. NTIS, PC A03/MF A01. Order Number DE83011222.

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SRC-II coal liquid was separated into nine fractions by preparative liquid chromatography. Two of the fractions, the very weak acids and the weak acids, were used as feeds in hydroprocessing experiments with sulfided Ni-Mo/$\gamma$-$Al_2O_3$ catalyst at 350C and 120 atm. Analysis of the feeds and products by infrared spectroscopy and gas chromatography/mass spectrometry showed that the principal components of these coal liquid fractions are substituted phenols and naphthols; the principal reactions were hydrodeoxygenations. The two fractions had similar compositions and approximately equal reactivities. The reactant compounds included 5,6,7,8-tetrahydro-1-naphthol, 4-cyclohexylphenol, methylphenylphenol, and 2-hydroxyphenylbenzene; rate constants for the conversion of each are approximately the same, about $10^{-4}$L/(g of catalyst.s). These compounds were converted an order of magnitude more rapidly than dibenzofuran in the neutral oils fraction of the SRC-II liquid under the same conditions. The hydrodeoxygenation of the acidic compounds is also rapid in comparison with other hydroprocessing reactions of coal liquids, such as hydrogenation of aromatic hydrocarbons and hydrodesulfurization and hydrodenitrogenation of heterocyclic compounds.

**38342 (DOE/FE/60181—15) Preliminary assessment of the use of stripped gas liquor (SGL) as cooling-tower makeup.** Willson, W.G. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1983. Contract FC01-83FE60181. 9p. (CONF-830643—1). NTIS, PC A02/MF A01. Order Number DE83013087.

From 3. biennial synfuels wastewater workshop; Morgantown, WV, USA (15 Jun 1983).

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With the goal of developing data on the nature and treatment/reuse of wastewater from the slagging fixed-bed gasification (SFBG) of lignite, a pilot-scale wastewater treatment train featuring reuse concentration in a cooling tower has been expected. For the baseline test minimal treatment, featuring solvent extraction and ammonia stripping, was used to prepare stripped gas liquor (SGL) for use as makeup for a cooling tower. The most cost-effective approach is to provide minimal treatment represented by solvent extraction for organics removal and steam stripping for ammonia and acid gas removal followed by reuse in a cooling tower without intermediate biological treatment. However, this wastewater contains several thousand mg/1 of COD - after phenolics and other organics are reduced to low levels. The behavior of these contaminants in a cooling tower with respect to drift, further biological activity, and associated fouling, and their effects on the solubility of dissolved solids is unknown. In order to assess the effectiveness of extraction and stripping alone in treating wastewater for cooling tower use, UNDERC has installed a pilot-scale wastewater treatment train consisting of solvent extraction and ammonia stripping to prepare SGL for testing as makeup in a small cooling tower. The corrosive effects of using SGL as a cooling tower feed are being examined using coupons and Rhorback Corrator and Corrosometer probes, as well as metallurgical examinations of heat transfer surfaces after testing is complete. Preliminary data from the Corrosometers show a high corrosion rate for carbon steel, varying from 12 to 45 mpy for the various locations in the systems. Corrosion rates for carbon steel, as noted by the Corrator probes, were also high, ranging from 4 to 21 mpy.

**38343 (DOE/MC/14061—1-Rev.1) Investigation of formation of nitrogen compounds in coal combustion. Interim technical progress report, 1 October 1980-31 August 1982.** Muenker, A.H.; Kuriskin, R.; Wendt, J.O.L. (Exxon Research and Engineering Co., Linden, NJ (USA)). 30 Nov 1982. Contract AC21-80MC14061. 199p. NTIS, PC A09/MF A01. Order Number DE83011473.

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This is an interim report which presents the results of work that has been performed on this contract. The results have not yet been evaluated; this will be reported subsequently. The work reported is divided into three tasks. They address the problems of the time-resolved pyrolysis rates of coal particles under simulated combustion conditions, the combustion of tar that results from such pyrolysis, and theoretical modeling of the pyrolysis process. Special attention is devoted to the fate of coal nitrogen in all of these tasks.

**38344 (DOE/MC/14705—T5) Coal-gasification support studies. Subtask 1-1. Effects of process variables on the initial coal-gasification reactions. Final report, May 1980-May 1982.** (Institute of Gas Technology, Chicago, IL (USA)). Jan 1983. Contract AC21-80MC14705. 37p. NTIS, PC A03/MF A01. Order Number DE83011601.

The effect of removing solvent-soluble fractions from Colorado subbituminous coal on devolatilization product yields was studied at a pressure of 500 psig over a temperature range of 800° to 1400°F in helium and hydrogen. Three solvents were used to prepare the extracted coals: n-hexane, benzene, and tetrahydrofuran (THF). The extracts were analyzed by gas and liquid chromatography, mass spectrometry, and X-ray fluorescence and the solids were subjected to infrared-spectroscopy and standard ASTM ultimate and proximate analyses. Qualitatively, n-hexane was the poorest solvent and tetrahydrofuran was the best. Interpretations of the data indicated that the effect of the extraction process on devolatilization yields was a combination of the change in chemical composition of the coal, the amount of solvent trapped in the extracted coal and possibly a change in the physical structure of the coal itself. This combination made it impossible to quantitatively determine the effect of removing the solvent-soluble fractions. Qualitatively, the extraction process causes the distribution of devolatilization products to change. This effect was more significant in a reducing atmosphere than in an inert He atmosphere. The change in product distribution was also more significant at high temperatures (1400°F) than at lower temperatures (800°F). In addition to the study of the extracted coal the effect of steam on the devolatilization behavior of Colorado subbituminous coal was investigated at 1400°F and 500 psig in both steam-helium and steam-hydrogen mixtures. This initial attempt to establish the role of selected solvent-soluble fractions contained within the coal matrix is illustrative of the complexity of gasification chemistry and how it may be affected by both physical and chemical changes of the coal. 5 figures, 5 tables.

38345 **(DOE/MC/16477—1421) Evaluation of the final data for the Pricetown I UCG field test via existing thermodynamic models. Final report, August 21, 1981-September 30, 1982.** Eddy, T.L.; Gibbs, R.T.; Jong, C.M.; Phouc, T.X.; Ford, W.H. Jr. (Georgia Inst. of Tech., Atlanta (USA). School of Mechanical Engineering). 31 Dec 1982. Contract AC21-81MC16477. 235p. NTIS, PC A11/MF A01. Order Number DE83013575.

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The final, corrected field-test data for the Pricetown I underground coal gasification project are averaged into five phases containing 63 stages. The resulting data are used to determine probable affected geometries of the reverse combustion linking (RCL), combustion link enhancement (CLE), and forward gasification (FG) phases. After RCL, the link diameters between production/injection wells 2-3 and wells 1-2 were 2.39 ft and 2.56 $ft^3$, respectively. About 71% of the volatile matter in the link was removed. CLE of the porous link occurred under both sublaminar and laminar flow regimes, with a consumption of about 95% of the volatile matter in the link. The CLE computer model predicts a link cross section of about 7 ft high by 32 ft wide at the injection well just prior to gasification. The extent of gasification during linking is found to be insignificant. During forward gasification, the absence of water (steam) and volatile matter near the injection region resulted in partial oxidation of the char being the major gasification reaction followed by downstream or periferal devolatilization. Based on thermocouple indications and the FG computer model cavity growth predictions, it appears that only 20% of the char reacted giving an average cavity height of 3.3 ft and maximum width of about 30 ft. Approximately 52% of the coal affected was recovered during the field test. The FG phase was apparently terminated because of the rapid temperature drop when the burden became exposed as indicated by thermocouple measurements and the FG model temperature calculations. This led to condensation and solidification of tars in the link and wells. It is imperative to maintain base temperatures by providing superheated steam and oxygen in future field tests, as well as to improve the quality of the product gas. 43 figures, 13 tables.

38346 **(DOE/MC/19301—2) Coal-gasification research studies. Quarterly report, November 20, 1982-February 19, 1983.** (Institute of Gas Technology, Chicago, IL (USA)). Apr 1983. Contract AC21-82MC19301. 30p. NTIS, PC A03/MF A01. Order Number DE83013293.

The Coal Gasification Research studies consist of three tasks: (1) studies of coal ash behavior, (2) high-pressure fluidization studies, and (3) high-temperature fluidization studies. The studies in coal ash behavior include a determination of the chemical and physical changes of the mineral constituents of coal during gasification, the construction and use of a needle penetrometer viscometer to measure the viscosity of coal ash melts and the analysis of ash agglomeration based on available phase equilibria. The fluidization studies are to determine the individual effects of pressure and temperature on the bubble characteristics (bubble size, frequency, and velocity) as a function of the fluidization velocity, particle size, particle density, bed height, and type of gas distributor. The high-pressure fluidization studies also include investigations on the effect of pressure on the operation of high-velocity fluidized beds. During this quarter, the needle penetrometer viscometer that is to be used to measure coal ash viscosities above $10^4$ poises was assembled and the testing plan finalized. The 2-inch-diameter fluidized-bed gasifier used to monitor chemical changes in ash constituents was modified to provide for intermittent sampling of solid bed material and to analyze the effluent gas for $H_2O$, $H_2$, CO, $CO_2$ and light hydrocarbon composition. In addition, the test plan for the ash characterization subtask was formalized. The modification of an existing high-pressure fluidization facility continues. Development of the mathematical expressions that relate pressure probe data to bubble-size distribution in the fluidized bed was completed and a computer program based on these expressions will be developed to perform data analysis. Modifications of the existing high-temperature unit to study bubble characteristics continues. 6 figures, 1 table.

38347 **(DOE/PC/30075—13) Crossed reaction networks in the catalytic hydrodenitrogenation of synthetic liquid fuels. Quarterly report, February 1, 1983-April 30, 1983.** Satterfield, C.N.; Smith, C.M.; Ingalls, M. (Massachusetts Inst. of Tech., Cambridge (USA)). 1983. Contract AC22-80PC30075. 16p. NTIS, PC A02/MF A01. Order Number DE83012026.

Studies at 375°C and 6.9 MPa revealed complex interactions between $H_2O$ and $H_2S$ which significantly affect the rate of overall hydrodenitrogenation. In the absence of $H_2S$, addition of $H_2O$ (generated in situ from decanol) produces an increase in the overall HDN rate that is rapidly reversible. When $H_2S$ is present, a comparable increase in overall rate is observed upon the addition of $H_2O$; however, most of this increase is maintained for a long period after the $H_2O$ is removed. A standard resulfiding procedure reduces the catalyst activity to the level it had before addition of water.

38348 **(DOE/PC/40784—FR-1) Dependence of liquefaction behavior on coal characteristics. Part I. A selective and critical review of the literature. Final technical report, March 1981-February 1984.** Given, P.H. (Pennsylvania State Univ., University Park (USA). Coal Research Section). May 1983. Contract AC22-81PC40784. 63p. NTIS, PC A04/MF A01. Order Number DE83011434.

For geological and geochemical reasons so far only known in general terms, coals have several bands of development of properties. These differences are significant also in considering liquefaction behavior. It is clear that coals of high sulfur content and at the lower end of the bituminous rank classes are particularly favorable for liquefaction. The US coals answering this description may have 5 to 8% total sulfur. In any case, it is the high sulfur coals that tend to give the highest yield of distillable products. Generally the effect of the mineral matter in determining liquefaction behavior of a coal has still to be found by trial-and-error. The product distribution desired in liquefaction products is different in different parts of the world, and may well vary with time as well. For example, in the USA, the objective is usually to make low sulfur fuel oil for steam-raising and industrial process heat, to replace petroleum products and conserve them for the production of transport fuels. On the other hand, in Germany and Australia, coal liquefaction is of interest to the extent that it can provide diesel oil and gasoline, even though this objective requires much greater quantities of hydrogen, which is expensive. Adjustment of product distribution to meet these different objectives will no doubt be achieved primarily by varying the severity of reaction conditions and also to some extent by the cost of the coal. To learn how to predict product composition from feedstock characteristics is the most difficult, but potentially the most rewarding, aspect of our attempts to provide a scientific basis for coal liquefaction.

38349 **(DOE/PC/40784—FR-2) Dependence of liquefaction behavior on coal characteristics. Part II. Liquefaction of low sulfur/low ash and high sulfur/high ash coals and their mixtures. Final technical report, March 1981-February 1984.** Sood, A.; Moon, W.G. (Gulf Research and Development Co., Pittsburgh, PA (USA)). May 1983. Contract AC22-81PC40784. 42p. NTIS, PC A03/MF A01. Order Number DE83011435.

This report presents the results of 17 coal liquefaction experiments done by Gulf Research and Development Company under Subcontract No. DOE-TPSU-GRDC-40784-224 from the Pennsylvania State University (PSU). This is the final report for the above subcontract. The chief objective was to determine liquefaction yields for three low sulfur/low ash coals, three high sulfur/high ash coals, and nine 50:50 mixtures of these coals. The experiments were performed in a bench-scale flow unit feeding a coal/solvent slurry to a 1-l, continuous-stirred tank reactor. In seven out of the nine individual coal comparisons, the high sulfur/high ash coals had higher OIL ($C_5$-900°F distillate) yields than the low sulfur/low ash coals. The two exceptions were observed with the PSOC 513 (low sulfur/low ash) coal which gave higher OIL yields than PSOC 760 and 607 (high sulfur/high ash) coals. It was suggested that PSOC 513 may have superior maceral properties, leading to higher OIL yields. For the coal mixtures, the OIL and SRC (pyridine-soluble material boiling above 900°F) yields were charac-

terized by a simple, unweighted, linear averaging rule in six of the nine cases. In other words, the OIL and SRC yields for the 50:50 mixtures were midway between those for the individual coal components. However, three significant exceptions to the linear averaging rule were observed with the PSOC 854/607, 708/607, and 513/666 coal mixtures. A synergistic effect appears to be occurring such that the OIL yield for the mixture was higher than that for either of the two coal components comprising the mixture. For example, the 854/607 coal mixture gave a 25.1% OIL yield compared to 5% for PSOC 854 and 10% for PSOC 607. The cause of this synergistic effect deserves further investigation by PSU.

38350 **(DOE/PC/40786—5) Heterogeneous kinetics of coal gasification. Quarterly technical progress report, 1 August 1982-31 October 1982.** Calo, J.M. (Brown Univ., Providence, RI (USA). Div. of Engineering). Nov 1982. Contract FG22-81PC40786. 60p. NTIS MF A01. Order Number DE83013759.

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The primary objectives are to develop a fundamental description of the chemical kinetics involved in coal-char gasification, and to evaluate the role of heat and mass transport processes via experimental techniques specifically directed at controlling these processes. During the past reporting period work was focused on investigating the interaction of char with CO. Several scoping experiments were performed with pure CO as the reactor feed, and $CO_2$ evolution and carbon deposition were observed both with char and with only inerts in the basket. It was concluded that the reverse Boudouard reaction could be catalyzed on the stainless steel walls of the reactor at high pressure. Significant effort was also devoted to analysis of $CO/CO_2$ char kinetic mechanisms. As a result of this work, an apparent inconsistency was found in the reaction mechanism proposed by Shaw, J.T. (1977). An experimental procedure, that takes advantage of transient kinetic techniques, was also formulated to establish whether the reverse reaction or adsorption of CO onto free carbon active sites, is responsible for the observed inhibition of steady-state char gasification with $CO_2$. Several changes were made in the automated mass programming and data acquisition methods.

38351 **(DOE/PC/40787—8) Enthalpy measurement of coal-derived liquids. Technical progress report, February 1983-April 1983.** Kidnay, A.J.; Yesavage, V.F. (Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering). 31 May 1983. Contract AC22-81PC40787. 9p. NTIS, PC A02/MF A01. Order Number DE83012971.

This quarter's work has concentrated on two primary areas. The first was the completion of experimental measurements of the associated factor. The second area was a look at current equation of state application. The work has progressed smoothly so far and should in future emphasize the computational work. The significant systems looked at this quarter were the $C_2$-$C_5$ alcohols, cresol, quinoline, and cresol-quinoline mixtures. The alcohols and cresols are important because the hydroxyl hydrogen bonding which is believed to be the primary association mechanism in coal liquids. Quinoline is significant because it is an excellent model for nitrogen containing constituents of coal liquids. The cresol-quinoline system, which was measured for range of system compositions, was studied because enthalpy data for a similar range of compositions was available. The results for most of these systems were reasonable and make important additions to previous data. The results for the quinoline-cresol mixture systems were curious and very different from anything previous to these measurements. The causes of these results are currently not well understood. Clearly they are due to complex interaction phenomena occurring in these systems. Since this behavior is not generally seen in complex mixtures, it is felt that the behavior is due to the fact that the cresol-quinoline system is a simple binary system which allows complex composition dependent solute-solute-solvent interactions to occur. This effect would also probably occur in ternary, quartenary, and maybe even higher systems. This behavior would tend to washout in coal liquids which have hundreds of components. As a result, it is felt that pure component systems are more valid models for coal liquid associations and that binary, etc., systems are too great a complexity to be currently understood.

38352 **(DOE/PC/40799—T6) Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, January 1, 1983-March 31, 1983.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). May 1983. Contract FG22-81PC40799. 12p. NTIS, PC A02/MF A01. Order Number DE83011910.

Flow cell Fourier Transform Infrared (FTIR) spectrometric detection of a wide variety of compounds separated by high performance liquid chromatography (HPLC) has become a useful tool in our laboratory for the elucidation of component structure in complex mixture analyses. HPLC/FTIR has, until recently, been accomplished only with semi-preparative or analytical-scale chromatography. By virtue of the relatively large volumes of elution solvent that are necessary on these scales, many infrared window-rich or exotic solvents have been too expensive to use routinely. Coupling of microbore HPLC columns to the FTIR has been shown to directly address this problem, and qualitatively the detectability appears comparable to the other chromatographic scales. The encouraging qualitative results from the semi-preparative/analytical/microbore HPLC/FTIR study which we have previously reported has prompted the following work on quantitation. For this study the primary effort was directed toward how increasing retention affects the detection limits of a particular type of compound. A series of nonpolar compound was chosen because of their known separation characteristics on silica gel. It was found that the signal to noise ratio decreases with increasing retention, probably due to the fixed sampling rate of the FTIR software used, but possibly also for other reasons considered. Detection limits were determined for toluene and other compounds.

38353 **(DOE/PC/41761—T2) Supported metal carbonyls: new catalysts for the liquefaction of coal. Final technical report.** Melson, G.A. (Virginia Commonwealth Univ., Richmond (USA). Dept. of Chemistry). [nd]. Contract AC22-81PC41761. 12p. NTIS, PC A02/MF A01. Order Number DE83012734.

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Alumina-supported cobalt-molybdenum catalysts were prepared from cobalt and molybdenum carbonyls and characterized by x-ray photoelectron spectroscopy, ion-scattering spectrometry, x-ray powder diffractometry and Raman spectroscopy.

38354 **(DOE/PC/50046—1) Removal of trace impurities from hydrogen recycle gas.** (Pittsburg and Midway Coal Mining Co., Denver, CO (USA)). Apr 1983. Contract AC22-82PC50046. 58p. NTIS, PC A04/MF A01. Order Number DE83013477.

The available data and information in the SRC-II demonstration plant design documents concerning contaminants in the hydrogen recycle gas which could be detrimental to operation of the cryogenic separation unit have been evaluated. The analytic information for $H_2S$, $CO_2$, and hydrocarbons is rather consistent, but the data for trace contaminants, particularly nitrogen oxides, is very uncertain. The maximum tolerable concentrations of trace contaminants in the cryogenic unit are also not well defined. The current demonstration plant design appears to provide for adequate removal of all trace compounds except nitric oxide. Facilities should be provided for further removal of nitric oxide. Further experimental and/or engineering work to resolve the present uncertainties would be useful, but would be unnecessary if the costly pretreatment requirements result in replacement of the cryogenic unit by another type of separation in future designs.

38355 **(DOE/PC/50786—4) Facile reaction/extraction of coal with supercritical fluids.** Squires, T.G. (Iowa State Univ. of Science and Technology, Ames (USA)). 1983. Contract FG22-82PC50786. 11p. NTIS, PC A02/MF A01. Order Number DE83012865.

The initial series of experiments were completed evaluating supercritical carbon dioxide as an extractant and reaction solvent for the liquefaction of coal. Baseline data on the solubility of coal in supercritical carbon dioxide at 40°C was obtained. Ames Lab Coal Library samples of Illinois No. 6 coal and a subbituminous coal (Adaville, Sorenson Mine, Lincoln, Co., Kemmerer, Wyo-

ming) were extracted directly. Additional experiments to investigate the effect of treating Illinois No. 6 coal with water or pyridine prior to $CO_2$ extraction were conducted.

**38356 (DOE/PC/50811—1) High P/T phase and volumetric behavior of coal-liquid constituents. Quarterly report, July 1, 1982-October 1, 1982 .** Kobayashi, R. (Rice Univ., Houston, TX (USA). Dept. of Chemical Engineering). 1982. Contract FG22-82PC50811. 3p. NTIS, PC A02/MF A01. Order Number DE83013069.

A versatile high temperature static apparatus, to measure the vapor pressures of both normally liquid and normally solid high-molecular-weight, condensed-ring hydrocarbons at elevated temperatures has been built and tested. This apparatus was used to study the vapor pressures and the heat of vaporization of three polynuclear aromatic compounds (carbazole, 9-Fluorenone and 9-hydroxyfluorene) with vapor pressures in the range of 1 mm to 1000 mm at elevated temperatures from 425 to 650°K. The above mentioned compounds are the homomorphic compounds of fluorene, a familiar coal derived component. The measured vapor pressures were fitted to Chebyshev polynomials. The Clapeyron equation was used to evaluate the heats of vaporization for all three compounds from their respective detailed values of (dp/dT), the compressibility factor of saturated vapor and liquid, acentric factor and estimated critical constant. A high temperature perturbation chromatography apparatus has been completed to obtain the high temperature and high pressure V-L-E phase equilibrium data of light gases in hydrogen-coal liquid model compound system. The perturbation chromatographic apparatus was applied to determine infinite dilution K-value of methane, ethane, propane, n-butane, $CO_2$, and $H_2S$ in dibenzofuran using deuterium perturbations to eliminate the free gas volume term. The results were satisfactory, but the experiments were restricted both in pressure and temperature. The temperature restrictions were due to the volatility of dibenzofuran and the pressure restrictions due to the inversion of the thermal conductivity chromatographic peaks at pressures exceeding 60 atmospheres.

**38357 (DOE/PC/50811—T1) High P/T phase and volumetric behavior of coal-liquid constituents. Quarterly report, October 1, 1982-January 1, 1983.** Kobayashi, R. (Rice Univ., Houston, TX (USA). Dept. of Chemical Engineering). 1983. Contract FG22-82PC50811. 3p. NTIS, PC A02/MF A01. Order Number DE83013125.

Vapor pressure measurements were carried out on three coal liquid model compounds using the apparatus discussed in the last report. The high pressure/high temperature perturbation chromatography apparatus was successfully applied to obtain K-values of several supercritical gases in the hydrogen 9-methylanthracene systems up to pressures as high as 200 atm and temperatures to 473 K.

**38358 (DOE/PC/51252—T1) Novel approaches concerning catalyst deactivation. Quarterly report No. 1, July 1, 1982-October 1, 1982.** Tsotsis, T.T. (University of Southern California, Los Angeles (USA). Dept. of Chemical Engineering). 1982. Contract FG22-82PC51252. 40p. NTIS, PC A03/MF A01. Order Number DE83011512.

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We focus our attention on simple models, which follow the quasi-steady hypothesis, such as uniform and shell-type of deactivation. Although the direct application of these models to realistic deactivation problems has recently come under attack, they have found, and still find, extensive application and use in problems of catalyst deactivation and reactor design. The great advantage of these models is that analytical expressions can be developed for the time dependent catalytic activity which can be directly utilized in problems of reactor design and optimization.

**38359 (FE—3048-1) Molten alkali-metal-hydroxide catalyzed coal liquefaction. Quarterly technical progress report, October-December 1978.** Skowronski, R.P.; Heredy, L.A. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). Jan 1979. Contract AC22-78ET13377. 33p. NTIS, PC A03/MF A01. Order Number DE83013507.

This is the first quarterly report on the development of the Rockwell International molten alkali metal hydroxide catalyzed coal liquefaction process. The objective of this project is to investigate experimentally the feasibility of using molten alkali metal hydroxide catalyzed hydrogenation to convert coal to nonpolluting liquid fuels. The process will be evaluated on the basis of maximizing liquid yields, with particular emphasis on distillate liquids, maximizing heteroatom removal, and minimizing gas production and hydrogen consumption. The first year of this effort consists of a laboratory test program to evaluate coal feedstocks, test the effects of eight operating parameters on the production of liquids, and evaluate potential materials of construction. Six experiments were conducted during the first quarter. Analysis of the gas-phase products was conducted by gas chromatography. Product distillations from three hydrogenation experiments have been completed. Literature research was conducted to select candidate materials of construction for use in a molten alkali metal hydroxide catalyzed coal liquefaction reactor. The field has been narrowed to three. Sample coupons of the three alloys, Inconel 600, 625, and 671 were obtained. Also, a considerable quantity of information on the physical properties of these materials has been gathered.

**38360 (PB—83-201020) Coal-gasifier wall-protection system slag-shedding technique.** Sanscrainte, W.; Marshall, D. (Bell Aerospace Textron, Buffalo, NY (USA)). Dec 1982. 95p. (NYSERDA—82-36). NTIS, PC A05/MF A01.

Design criteria for wall-protection systems for commercial coal gasifiers was developed utilizing laboratory-scale data and the test results from a 1/2-ton/h gasifier. The work extended the findings of contract 106/ET-FUC/78-79. Slag sticking temperatures, T/sub s/, were established by lab tests. These tests exposed selected materials specimens to a slag-powder-fed, oxyacetylene flame spray. Specimen surface temperature versus slag-flame-spray exposure time show slag buildup and shedding cycles at temperatures below T/sub s/. Surface roughness and slag precoating reduced T/sub s/ values. Two of the materials exposed to the slag flame spray were incorporated into the liner of a 16-inch-long cylindrical test section of High Mass Flux (HMF) gasifier. The liner incorporated longitudinal cooling passages. The HMF gasifier process-development facility at Bell Aerospace is described. Three HMF tests of 30 to 45 minutes duration were carried out. Post-run observations and thermal data from the test-section-liner cooling water show a random process of a thin layer of ash and slag buildup and falloff. The liners successfully demonstrated the objective of eliminating detrimental slag adherence and buildup for the test durations. Thermal analyses of the run data indicate that the process includes heat transfer by mass transfer. The test data will be used to conservatively design a full-size combustion chamber of a commercial HMF gasifier. The full-size design appears to be structurally feasible. The total energy loss for the chamber cooling would be less than 1% of the energy value of the coal consumed. 51 figures, 13 tables.

**38361 (SAND—82-2363) Valve-materials performance observed in bench and simulated coal gasification/liquefaction testing.** Lucas, J.P. (Sandia National Labs., Albuquerque, NM (USA)). May 1983. Contract AC04-76DP00789. 125p. NTIS, PC A06/MF A01. Order Number DE83013531.

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This survey report presents the general contributions and high level scientific efforts of research laboratories, universities, and materials manufacturers toward solving valve-materials problems associated with coal-conversion processing. The various wear tests devised to simulate the in-service conditions experienced by valve materials are emphasized. A detailed description of these wear tests and interpretation of the data gathered are discussed with respect to the wear properties measured. Mechanical, physical, and wear properties as well as the characteristics of various types of potential valve materials are given. Different classes of materials are presented separately - bulk metallic materials, coatings, and hardfacings, and cemented carbides - in order to stress their beneficial properties for valves application for specific material categories. In addition, new materials and special processing methods used to produce these advanced materials are discussed relative to their valve application potential. Test results presented represent a wide range of conditions relative to the temperatures at which the valve materials are required to operate, the chemically active species that are flow-

controlled, and the various parameters associated with the abrasive and erosive nature of the various flow media transported.

38362 **(UCRL—50026-82-4) LLNL underground coal-gasification project. Quarterly progress report, October-December 1982.** Stephens, D.R.; Clements, W. (eds.). (Lawrence Livermore National Lab., CA (USA)). 17 Mar 1983. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01. Order Number DE83013699.

Further analysis has been done on the cavity excavation data obtained in the large block (LBK) experiments, which were done at a coal mine in the Tono Basin near Centralia, Washington, in the winter of 1981-82. The cavity shapes determined by the LBK excavations were reported in a previous quarterly report. The new analysis determines for each observed cavity an equivalent cavity having an elliptical transverse cross section; such equivalent cavities are better suited for use in computer models of the underground coal gasification (UCG) process. Our next UCG field experiment will be a second test of the CRIP (controlled retracting injection point) technique, this one to be on a larger scale than the CRIP test done during the LBK experiments. Designated as a partial-seam CRIP test, it will be done in the same area as the LBK experiments. Only the top half of the coal seam will be gasified, to ensure plenty of roof interaction. The burn is scheduled to continue for 36 days, which should provide time for a number of CRIP movements of the injection point. Information gained in this experiment will be used to plan one or more full-seam CRIP tests in the same area. 17 figures, 5 tables.

38363 **Determination of the degree of association of coal-derived products by vapor pressure osmometry.** Lee, W.C.; Schwager, I.; Yen, T.F. (Univ. of Southern California, Los Angeles). pp 129-140 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—). Contract AC22-75ET10626.

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

Vapor-pressure osmometry (VPO) has been used to study the association of coal-derived asphaltenes obtained from coal liquids produced in five major coal liquefaction demonstration processes. This is the first time that VPO has been used to correlate the degree of association of coal-derived asphaltenes. The molecular weights of coal-derived asphaltenes have been determined by VPO as a function of concentration in the solvents benzene, tetrahydrofuran, chloroform and N,N-dimethyl formamide. All the asphaltenes afford positive correlations between VPO molecular weight and concentration in benzene and tetrahydrofuran, and these correlations are linear in dilute solutions (4 to 30 g/l). This indicates that association of asphaltenes takes place in both solvents over the concentration range of 4 to 60 g/l. A model of the association of asphaltenes in solution has been derived, and the association constants have been calculated with the aid of the modern computer. The average molecular weights based on the model agree very well with those obtained from VPO.

## 0105 By-products

*REFER ALSO TO CITATION(S) 38371*

## 0106 Properties

*REFER ALSO TO CITATION(S) 38339, 38348, 38349, 38351, 38352, 38356, 38357, 38363, 38394, 38415, 38430, 38577*

38364 **(ARL-TR—32) Erosion of materials using recirculated coal-liquid mixtures.** Al Taweel, A. (National Research Council of Canada, Halifax, Nova Scotia). 1982. 27p. (NRCC—19915). National Research Council of Canada, Halifax, Nova Scotia.

A quick test for evaluating the erosion characteristics of coal/liquid mixtures was developed and was used to follow variation of the fuel's erosive action as it was recirculated. Minor changes in the fuel characteristics were detected and it is estimated that the fuel could be recirculated at least 15 times while keeping the erosion rate within 5% of the mean. A larger number of recirculations may be permissible provided special attention is given to keep impingement velocity constant throughout the test. (52 refs.)

38365 **(DOE/PC/40789—T6) Thermal and radiative properties of coal-ash deposits. Technical progress report No. 6, March 1, 1982-May 31, 1983.** Anderson, D.W.; Vader, D.T.; Zumbrunnen, D.A.; Incropera, F.P.; Viskanta, R. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). 1983. Contract FG22-81PC40789. 10p. NTIS, PC A02/MF A01. Order Number DE83013093.

Progress reports are presented for the following: High Temperature Test Facility (HTTF); effective conductance of particulate deposits; and measurement of radiative properties of coal ash deposits. Some of the highlights for this period are: (1) The HTTF was operated as a complete system for the first time and preliminary results were obtained for the thermal conductance of an ash deposit. Experimental procedures and methods were evaluted, and valuable information was obtained for improving the experimental methods. (2) Data acquisition procedures, experimental methodology, and sample preparation procedures have been refined for an improved test cell to be used with the low temperature kiln (1250°C). Results of tests with 2 surrogate materials, Babcock and Wilcox insulating firebrick and zirconia specimens, indicate that the effective conductance is strongly influenced by the sample thickness, decreasing with decreasing thickness. (3) Recent efforts have been directed toward the selection of instruments and materials that will be needed to assemble the test facility for measuring the radiative properties of coal ash deposits.

38366 **(DOE/PC/40793—T7) Predictors of plasticity in bituminous coals. Technical progress report No. 7.** Lloyd, W.G.; Reasoner, J.W.; Hower, J.C.; Yates, L.P.; Clark, C.P.; Davis, E.; Fitzpatrick, A.; Reagles, C.L.; Whitt, J.M. (Western Kentucky Univ., Bowling Green (USA). Ogden Coll. of Science, Technology and Health). 13 Jun 1983. Contract FG22-81PC40793. 118p. NTIS, PC A06/MF A01. Order Number DE83013420.

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The 40-coal database for the prediction of the plastic properties of hvb coals has been completed. Statistical analysis has been commenced. Most of the 37 ostensibly independent experimental variables and the 22 derived variables are shown to have little or no predictive power. Approximately a dozen independent variables appear to be systematically related to plasticity. Maximum fluidity can be determined in several ways from Gieseler plastometer data. Under both ASTM and isothermal conditions, maximum fluidity can be predicted using just two independent variables with a standard linear regression model of the form $\ln(\text{maximum fluidity}) = \beta_0 + \beta_1 * V_1 + \beta_2 * V_2$ with correlation coefficients greater than .85. The use of three or four independent variables permits predictions with R greater than .90. Pyrolysis gas chromatography has emerged as a powerful and relatively inexpensive new tool for the characterization of coals. In conjunction with studies of extraction, extract characteristics, and residue swelling, pyrolysis/GC affords insights into the basic factors determining the plastic behavior of coals.

38367 **(DOE/PC/50790—T1) Role of preasphaltenes in coal conversion reactions. First quarterly report.** Hill, G.R. (Utah Univ., Salt Lake City (USA). Biomaterials Profiling Center). 25 Apr 1983. Contract FG22-82PC50790. 7p. NTIS, PC A02/MF A01. Order Number DE83012275.

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Work planned for the first half of year 1 of this project is primarily aimed at development of methods and procedures for the production and characterization of coal derived preasphaltenes. Accordingly, the following tasks were addressed: (1) construction and testing of a special mass spectrometry (MS) system with Field Ionization and tandem MS capabilities for preasphaltene characterization; (2) development and testing of special inlet systems for pyrolysis/desorption of preasphaltenes directly in front of the ion source; (3) improvement of a rapid heating tubing bomb reactor for production of short contact time preasphaltenes; and (4) continued

development of computerized multivariate analysis methods for mass spectrometric data. Highlights of the first quarter are: (1) the high vacuum system of a new tandem mass spectrometer was successfully completed and tested; (2) a direct probe pyrolysis/desorption inlet was completed and construction of Curie-point and $CO_2$ laser inlets started; (3) the heat-up time of the tubing bomb reactor was reduced to less than 15 seconds and the temperature overshoot problems corrected; and (4) development of interactive computer graphics for MS data was started. 4 figures.

**38368 (DOE/PC/50790—T2) Role of preasphaltenes in coal conversion reactions. Second quarterly report.** Hill, G.R. (Utah Univ., Salt Lake City (USA). Biomaterials Profiling Center). 25 Apr 1983. Contract FG22-82PC50790. 8p. NTIS, PC A02/MF A01. Order Number DE83012354.

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Work planned for the first half of year 1 of this project is primarily aimed at the development of methods and procedures for the production and characterization of coal-derived preasphaltenes. The following tasks, as started in the first quarter and described in the first quarterly report, were further addressed or completed in the second quarter: (1) construction and testing of a special mass spectrometry system with Field Ionization and tandem MS capabilities for preasphaltene characterization; (2) development and testing of special inlet systems for pyrolysis/desorption of preasphaltenes directly in front of the ion source; (3) improvement of a rapid heating tubing bomb reactor for production of short contact time preasphaltenes; and (4) continued development of computerized multivariate analysis methods for mass spectrometric data. Highlights for the second quarter are: (1) successful completion and testing of the new field ionization MS system; (2) construction of a Curie-point pyrolysis inlet and marked progress towards the development of a $CO_2$ laser probe inlet module; (3) successful short contact time (30 s) liquefaction test runs with the modified tubing bomb reactor; and (4) completion of an interactive graphics program for MS data.

**38369 (DOE/PC/50807—T2) Reaction calorimetry for coal chemistry and catalysis. Quarterly report, January 21, 1982-April 27, 1983.** Arnett, E.M. (Duke Univ., Durham, NC (USA). Dept. of Chemistry). [nd]. Contract FG22-82PC50807. 11p. NTIS, PC A02/MF A01. Order Number DE83011186.

Thermochemical investigations of solid acid zeolite and three coal samples of different grades (subbituminous Wyoming Rawhide, Texas Big Brown Lignite, and Illinois No. 6 Bituminous) have been initiated. The Setaram calorimeter is working well and this report includes calibration measurements and examination of the effect of temperature variation on the heats of reaction of these coals with aqueous solutions of tetrabutylammonium hydroxide and the effect of mesh size on such heats. Investigation has begun on the use of a Microscal absorption and flow calorimeter which looks very promising for the study of the thermochemistry of adsorption of liquid acids or bases on solids. 2 figures.

**38370 (ECN—133) Effect of coal properties on the fluidized bed combustion efficiency of single coals and blends.** Vleeskens, J.M. (Stichting Energieonderzoek Centrum Nederland, Petten). May 1983. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83750934.

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The influence of coal properties on fluidized-bed combustion efficiency was studied. The results could form a tool to predict from laboratory data the combustion efficiency of coals relative to standard coals for a specific design. A fluidized-bed combustor consuming 5 kg of coal per hour was operated under the nominal conditions: 850 degrees C/0.1 MPa/33% excess air/1.4 ms(sup -1). Washed coals of different origin and rank were burned as single type coals as well as in blends. The coals were characterized by chemical and petrographic analysis. The combustion efficiency was determined from the weight of unburnt matter in the fly ash. The combustion efficiency of single coals decreased with increasing rank. A correlation was established between combustion efficiency and vitrinite reflectance or carbon content. A less satisfactory correlation was found when volatile matter was used as a combustion parameter. No apparent correlation was observed between combustion efficiency and grain sizes in the range 1-10 mm, ash contents below 16%, or inert-to-reactive ratios. The combustion efficiency of blends was intermediate between those of the constituent coals, in linear proportion to the blending ratio. Only one of the types of coals used, which on closer inspection was found to contain a multitude of fine fissures, did not follow the observed correlation.

**38371 (EUR—7850-f) Physical and chemical beneficiation of coal and its by-products (Report on ECSC contract 7220-EC/306).** (Commission of the European Communities, Luxembourg). 1982. 78p. (In French). Commission of the European Communities, Luxembourg.

The development and testing of a rapid-heating microwave furnace for studying the pyrolysis and ignition mechanisms of pulverized coals is described. Work on coal liquefaction especially the development of analytical methods to determine the characteristics of hydrogenated oils, was also carried out. The characteristics of pitches in solution in bromoform, was studied by nuclear magnetic resonance, and their binding power with regard to petroleum coke as a function of their aromaticity was also determined. Finally, the preparation of ultra-light aggregates using coal shale in slate clays was investigated. (In French)

**38372 (TNO-CL—82-159) A study of the composition and morphology of fly ash from coal-burning installations. Final report, January 1980 December 1981. Part 2.** Gay, A.J.; Von Rosenstiel, A.P. (TNO Division of Technology for Society, Delft, Netherlands). Apr 1982. 43p. TNO Division of Technology for Society, Delft, Netherlands.

This report concerns a study of fly ash originating from a US bituminous coal burned in an experimental fluidized bed combustor (FBC) with the addition of sorbent (limestone). The morphology of this type of fly ash is discussed. Bulk analysis of sized fractions has shown an increase in the concentration of some elements with decreasing particle size. Surface analysis has shown an enrichment in some elements (particularly carbon) on the surface of fly ash particles. The results are compared with those for the fly ash originating from the same coal burned in a PCC and in the same experimental FBC without addition of sorbent.

**38373 Chemical and geochemical aspects of fossil energy extraction.** Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). 276p. (CONF-800814—). Ann Arbor Science Publishers, 230 Collingwood, P.O. Box 1425, Ann Arbor, MI 48106.

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

Research in the area of fossil energy extraction chemistry and geochemistry is discussed herein. Most of the material presented in this book was included in papers in a symposium entitled Chemical and Geochemical Aspects of Fossil Energy Extraction at the Second Chemical Congress of the North American Continent, Las Vegas, Nevada, August 26-28, 1980. The contents of the book are divided into 4 sections entitled: Petroleum, Coal, Oil Shale, and Geothermal. Separate abstracts have been prepared for 14 of the 15 chapters. (BLM)

**38374 Characterisation of covalent constituents in a coal conversion solid waste.** Hoffman, W.A. Jr.; Lindberg, S.E.; Turner, R.R. (Oak Ridge National Lab., TN). *Environmental Pollution, Series B: Chemical and Physical;* 4: No. 3, 219-229(Nov 1982). Contract W-7405-ENG-26.

A solid waste derived from the gasification of solvent-refined coal (SRC-II) mineral residue contained both elemental sulphur ($S^0$) and organic compounds. These constituents were extracted directly from the waste with dichloromethane. Free sulphur comprised ~1% by weight of the waste. The organic compounds identified--conjugated carbon ring systems with molecular weight below and including anthracene--were below 0.001% levels. On equilibration with water, concentrations of dissolved or suspended organic compounds reached a maximum in about 1 h and then decreased with time. Organic compounds present do not appear to have metal-active functional groups that would contribute significantly to ion mobility in the waste under leaching conditions.

## 0108 Waste Management

*REFER ALSO TO CITATION(S) 38342, 38371, 38372, 38374, 38421, 39345, 39348*

**38376 (BEOP—19) Survey of coal residue research in the Netherlands.** (Stichting Energieonderzoek Centrum Nederland, Petten. Bureau Energie Onderzoek). Jan 1983. 148p. (In Dutch). Stichting Energieonderzoek Centrum Nederland, Petten.

A survey of ongoing and finished research activities related to the use of coal residues (ash, fly ash, slags) as raw materials for a number of products. The inventory is far from complete, due to poor response to the questionnaires which were distributed. Projects were split into five groups: 1) characterization of residues; 2) environmental effects; 3) transport and storage; 4) research on the possible application of the product, and 5) the development of the specific application for some products (concrete, artificial sand or gravel, mineral wool, gypsum, etc.). Most of the attention is paid to projects related to the residues of coal fired power stations. The major part of the research is directed to the industry involved with the combustion of coal and the engineering consultants. The report consists of a number of tables with relevant data (name and description of the project, contractor, supervisor, engineering partners).

**38378 (DOE/ET/15492—T40) Laboratory/bench scale testing and evaluation of A.P.T. Dry Plate Scrubber. Thirteenth quarterly progress report, March 1-May 31, 1983.** Yung, S.C.; Duncan, M. (Air Pollution Technology, Inc., San Diego, CA (USA)). 17 Jun 1983. Contract AC21-80ET15492. 11p. NTIS, PC A02/MF A01. Order Number DE83013627.

The objective of this project is to conduct a bench scale experimental evaluation of the Dry Plate Scrubber (DPS) at high temperature and pressure to determine its potential for controlling particulate and alkali vapor emissions from Pressurized Fluidized-Bed Combustion (PFBC) processes. The major technical objectives for this quarter are to repair the HTP-DPS system and continue particle and alkali vapor removal experiments, at 850°C and 10 atmosphere pressure. During the month of May, experiments for particle collection were continued at 600°C and about 9.5 atmosphere pressure. The effect of electrostatic augmentation on particle collection efficiency was studied. Experimental conditions and results of these experiments are discussed. 2 figures, 3 tables.

**38377 Separation and identification of the organic species in coal conversion process wastewater.** Tang, J.I.S. (Univ. of Southern California, Los Angeles); Yen, T.F.; Kawahara, F.K. pp 85-106 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—).

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

Coal conversion wastewater samples obtained from Union Carbide (scrubber water of coal hydrocarbonization process) and PAMCO (recycle process water of coal liquefactin process) were fractionated through column separation and the resulting fractions analyzed by gas chromatography-mass spectrometry (GC-MS). Amberlite macroreticular resin (XAD-8) with ion exchange resins was employed to obtain hydrophilic fractions and the subsequent neutral, acid and base subfractions. A Finnigan 3200 GC-MS coupled to Incos data system was employed to identify major phenolics, chlorinated aromatics, aromatic amines and amides, substituted pyridines, quinolines, indoles, biphenyls, oxygen-containing compounds and saturated cyclic compounds. Organic sulfur species and polynuclear aromatic hydrocarbons (PAH) (except biphenyls) were not found under the current experimental conditions, which may prevent the detection of ultra-low level organic species. Origin of the more abundant types of organics will be interpreted in terms of the biochemical and geochemical pathways.

## 0109 Environmental Aspects

*REFER ALSO TO CITATION(S) 38434, 38480, 39389*

**38378 (DOE/ET/14746—10) Baseline discharge inventory and control technology review for coal-gasification systems.** Maruhnich, E.D.; Weber, R.C.; Nakles, D.V.; Fillo, J.P.; Rittmeyer, R.W.; Bratina, J.E. (Carnegie-Mellon Inst. of Research, Pittsburgh, PA (USA); Environmental Research and Technology, Inc., Pittsburgh, PA (USA)). Dec 1982. Contract AC01-80ET14746. 87p. NTIS MF A01. Order Number DE83011833.

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Environmental Research & Technology, Inc. is conducting investigations and research for the purpose of contributing to the comprehensive health and environmental data base currently being developed for surface coal gasification. One of the key elements of the work is concerned with the development of a fundamental understanding of pollutant formation and distribution with gasification process and assessment of environmental control technologies for the control of these pollutants. This report focuses on the results and findings of initial efforts conducted to define baseline gasification plant configurations; the production, fate and distribution of hydrocarbons, sulfur and nitrogen-bearing compounds within the configurations; and baseline plant discharge inventories and control technology evaluations. For this study, the definition of baseline plants included the matrix of three principal process types (fixed bed, fluidized bed and entrained flow) and major product and uses categories (low/medium Btu gas, synthetic natural gas (SNG) and liquid products). An integral part of this baseline plant definition included an inventory of unit operations and sources of uncontrolled discharges. Within each of the gasification process types, the production of hydrocarbons, sulfur and nitrogen-bearing species/pollutants is characterized. Subsequently, the fate and distribution during downstream gas processing is also described. Preliminary analyses of control technologies for management of air, water and solid waste discharges for the baseline plant configurations have been initiated and are presented herein. 22 figures, 1 table.

**38379 (DOE/ET/14746—12) Assessment of health, safety and environmental impacts of Department of Energy coal-conversion processes. Final report, July 2, 1980-December 31, 1982.** Bratina, J.E.; Craun, J.C.; Fillo, J.P.; Herman, D.R.; Nakles, D.V. (Carnegie-Mellon Inst. of Research, Pittsburgh, PA (USA); Environmental Research and Technology, Inc., Pittsburgh, PA (USA)). Jan 1983. Contract AC01-80ET14746. 140p. NTIS, PC A07/MF A01. Order Number DE83012508.

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This final report addresses the Department of Energy (DOE) contract to Carnegie-Mellon Institute of Research (CMIR) and its subcontractor, Environmental Research and Technology, Inc. (ERT) for contract period of July 2, 1980 to December 31, 1982. The major activities of this contract consisted of an experimental test program implemented at CMIR on an entrained flow (riser) reactor and gasification/liquefaction environmental consulting services. The gasification consulting services emphasized the development of discharge inventories for generic coal conversion facilities, the completion of control technology surveys for proposed coal gasification facilities, including a comprehensive review of sulfur control technology options, and the development of a test-data data base architecture for incorporation into the Morgantown Energy Technology Center's (METC) computerized gasification technology data base management system. Liquefaction consulting services addressed the documentation and verification of selected environmental sampling efforts at the SRC-II and H-Coal pilot plants as well as an investigation of the impact of hydrotreatment on the chemical and toxicological properties of coal-derived liquids. This report does not represent a comprehensive coverage of these contract activities. Rather, it summarizes the work performed (both chronologically as technically) and references key topical reports produced during this contract should more detailed descriptions of the contract activity be required by the reader.

**38380 (DOE/PC/51260—1) Boron as a tracer for aerosol from combustion of coal. First quarterly technical report.** (Rhode Island Univ., Narragansett (USA). Graduate School of Oceanography). 1983. Contract FG22-82PC51260. 2p. NTIS, PC A02/MF A01. Order Number DE83013100.

Studies are being performed to determine if boron can be used as a tracer to indicate whether the sulfur compounds in the atmosphere come from coal (or oil) from the Midwest or Northeast. The abundance of boron is being surveyed in gas, aerosols, and precipitations at various sites in the U.S. This report presents data resulting from analysis of 42 samples collected from 2 sites in Eastern Ohio. Results indicate that both gaseous and particulate boron are easily detectable and exists in almost totally gaseous form and that $B/SO_2$ ratios for these samples are remarkably close to $B/SO_2$ ratios for coal.

**38381 (DOE/PC/51260—2) Boron as a tracer for aerosol from combustion of coal: second quarterly technical report.** (Rhode Island Univ., Narragansett (USA). Graduate School of Oceanography). 1983. Contract FG22-82PC51260. 2p. NTIS, PC A02/MF A01. Order Number DE83013348.

Studies are continuing to determine if boron can be used as a tracer to indicate whether the sulfur compounds in the atmosphere comes from coal (or oil) from the Midwest or Northeast. The abundance of boron in gas, aerosols, and precipitations is being surveyed at various sites in the U.S. This report presents data of archived samples collected from Narragansett, Rhode Island, La Jolla, California, Oahu, Hawaii, and Ft. Collins, Colorado. Results indicate that the ocean is a strong source of boron to the atmosphere. Determination of $SO_2$ on samples collected at Narragansett revealed a good correlation between $SO_2$ and wind direction. Highest $SO_2$ levels were seen from directions of Providence, RI and Boston, MA, suggesting that local sources of $SO_2$ were important to the Naragansett area. $B/SO_2$ ratios at Narragansett were higher than those observed in Ohio, primarily due to lower $SO_2$. It is concluded that transport of $SO_2$ from the Midwest is not generally observed in Narragansett.

**38382 (DOE/PC/51260—3) Boron as a tracer for aerosol from combustion of coal: third quarterly technical report.** (Rhode Island Univ., Narragansett (USA). Graduate School of Oceanography). 1983. Contract FG22-82PC51260. 8p. NTIS, PC A02/MF A01. Order Number DE83012162.

Studies are continuing to determine if boron can be used as a tracer to indicate whether the sulfur compounds in the atmosphere come from coal (or oil) from the Midwest or Northeast. The abundance of boron in gas, aerosols, and precipitations is being surveyed at various sites in the U.S. In this report, $B/SO_2$ ratios for all samples analyzed to date for Narragansett, Rhode Island, eastern Ohio, and Ft. Collins, Colorado are presented. Elevated B in the Northeast at the end of May can be qualitatively linked to the Midwest using wind direction. Plots of $SO_2$, $SO_4$, and the $SO_2/SO_4$ ratios vs. resultant wind direction are also presented for Narragansett. The highest concentrations of $SO_2$ come with the NE winds which sulfate is transported often from the southeast. Air masses transported to Whiteface Mountain, N.Y. from the west-southwest have order-of-magnitude higher $SO_2/SO_4$ ratios.

**38383 (N—8314575) Automatic interpretation of MSS-LANDSAT data applied to coal refuse site studies in southern Santa Catarina State, Brazil.** Parada, N.D.J.; Kux, H.J.H.; Valeriano, D.D.M. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). May 1982. 12p. (CONF-8206185—1; E—83-10066; NASA-CR—169577). NTIS, PC A02/MF A01.

From 16. international symposium on remote sensing of environment; Buenos Aires, Brazil (2 Jun 1982).

The coal mining district in southeastern Santa Catarina State is considered one of the most polluted areas of Brazil. The author has identified significant preliminary results on the application of MSS-LANDSAT digital data to monitor the coal refuse areas and its environmental consequences in this region.

**38384 (PB—83-172189) Surface subsidence over longwall panels in the western United States. Monitoring program and preliminary results at the Deer Creek Mine, Utah. Information circular/1982.** Allgaier, F.K. (Bureau of Mines, Denver, CO (USA). Denver Research Center). Dec 1982. 30p. NTIS, PC A03/MF A01.

A monitoring network has been established at the Deer Creek Mine to measure subsidence over four adjacent longwall panels. To date, two panels have been mined. Subsidence began as the first panel was mined and continued for 1 year following completion of the panel, during which time the adjacent panel was mined. A maximum of 2.7 feet of subsidence occurred over the two longwall panels mined at a depth of 1,500 feet. Because of the length of time that subsidence continued after mining, the final subsidence profiles and angle of draw have not yet been determined.

**38385 The 2 MW(sub TH) AFBC demonstration project in Petten.** Heil, J.A.; Feliks, W.A. Petten, Netherlands; Stichting Energieonderzoek Centrum Nederland (1983). 26p. (In Dutch). (ECN—83-047). Available from ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

In 1977 the Netherlands Energy Research Foundation (ECN) started a coal research program. To study all the aspects of coal combustion it was decided to build a demonstration plant based on atmospheric fluidized-bed combustion integrated in the heating system of the research centre. This report describes the AFBC pilot installation and the experiments conducted with this boiler at Petten.

**38386 Effects of coal liquid water-soluble fractions on growth and survival of four aquatic organisms.** Dauble, D.D.; Fallon, W.E.; Gray, R.H.; Bean, R.M. *Archives of Environmental Contamination and Toxicology;* **11**: 553-560(1982). Contract AC06-76RL01830.

Toxicities of water soluble fractions (WSF) derived from a fresh and water-leached solvent-refined coal (SRC II) material were compared by observing freshwater organism response to chronic exposure. Concentrations, relative distributions, and loss over time of phenols and aromatic hydrocarbons differed between aqueous extracts derived from fresh and leached SRC II material. Readily water-soluble phenols predominated in initial WSFs; higher molecular weight compounds with relatively lower solubility predominated in leached WSFs. Suppression of growth, reproduction and survival of invertebrates, Chironomus tentans, Tanytarsus dissimilis, and Daphnia magna and the algae Selenastrum capricornutum, were observed at concentrations ranging from 0.02 to 0.42% of WSFs derived from fresh SRC II liquid and 0.80 to 3.95% of WSFs derived from leached SRC II material. Alga populations were the least sensitive to WSFs generated from the coal liquid. Based on equal concentrations of carbon or phenols, solutions derived from leached SRC II liquids were usually more toxic to test species. Data suggest that tests of potential long-term effects of complex materials must be designed and interpreted on the basis of organism exposure to compounds most likely to persist in the environment.

**38387 Advanced optical techniques for diagnostics, control and safety in fossil energy conversions.** Murphree, D.L. (Mississippi State Univ., Mississippi State); Beiting, E.J.; Stickel, R.E.; Kumar, R.A.; Lau, T.K. pp 113-120 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). (CONF-821121—). Contract AC02-80ET15601;FG22-81PC40791.

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

Microprocessor-controlled, optical diagnostic instrumentation systems are being developed at Mississippi State University for the US Department of Energy's (DOE) magnetohydrodynamic (MHD) program and other fossil energy technologies. Three of these instrumentation techniques are described. The sensitivity of the temperature gradient of the combustion flame to a change in stoichiometry indicates a possible optical stoichiometric control technique. A microprocessor-controlled, packaged optical instrument for non-intrusive measurement of nitric oxide (NO) concentration in a combustion gas is described. Experimental results are pre-

sented using coherent anti-Stokes Raman spectroscopy (CARS) for spatially and temporally resolved temperature measurements in a simulated coal-fired environment.

## 0110 Reserves And Exploration

**38388 (PB—83-168807) Deep-minable coal resources of Illinois.** Treworgy, C.G.; Bargh, M.H. (Illinois Inst. of Natural Resources, Champaign (USA). State Geological Survey Div.). 1982. 73p. NTIS, PC A04/MF A01.

Deep-minable coal resources lie more than 150 feet below the surface and are generally mined by underground methods. Of the 181 billion tons of identified coal resources in Illinois, 161 billion tons (89%) are classified as deep-minable. About 44 billion tons (27%) of these have thickness and depth similar to coals currently being mined in Illinois, and thus are considered to have a high potential for development. In Illinois, deep-minable coal resources are distributed over 67 counties. Resources with a high potential for development are concentrated in the west-central, southwestern, and southern parts of the coal field, and resources with a moderate or low potential are concentrated in the central, eastern, and north-central parts of the coal field. Deep-minable resources comprise 13 different seams; however, of the resources with a high potential, 32 billion tons (72%) are from the Herrin (No. 6) Coal Member and 9 billion tons (20%) are from the Springfield (No. 5) Coal Member. These two seams will continue to be the major sources for underground coal production in the state.

**38389 (PB—83-173161) Strippable coal resources of Illinois. Part 7. Vermilion and Edgar Counties.** Jacobson, R.J.; Bengal, L.E. (Illinois Inst. of Natural Resources, Champaign (USA). State Geological Survey Div.). 1981. 60p. NTIS, PC A04/MF A01.

This report contains estimates of strippable coal resources (defined as coal 18 inches or more thick and with overburden not exceeding 150 ft.) of Danville (No. 7) and Herrin (No. 6) Coal Members of the Carbondale Formation, Kewanee Group, Pennsylvanian System, in Vermilion and northeastern Edgar Counties, Illinois.

**38390 (USGS-OFR—78-1027) Geology and strippable federal coal resources in the south half of the Dunn Center lignite field, Dunn County, North Dakota.** Menge, M.L. (Geological Survey, Reston, VA (USA)). 1978. 136p. Geological Survey, Open File Service, 25425-Denver Federal Center, Denver, CO 80225.

During the summer of 1975, Natural Gas Pipeline Company of America (NGPL), with the permission of the Bureau of Land Management, drilled 157 coal test holes into federally owned coal in the south half of the Dunn Center lignite field. This report presents the results and evaluations derived from that drilling. The Dunn Center lignite field lies entirely within Dunn County, North Dakota. Exposures of bedrock within the study area are of the Sentinel Butte Member of the Fort Union Formation (Paleocene). This member contains the four coal beds discussed in detail in this report: from deepest to shallowest, the Dunn Center, A, B, and C. These beds are, all or in part, shallow enough (within 150 ft; 45.7 m of the surface), thick enough (at least 30 in.; 76 cm), and of sufficient lateral extent to be economically extracted using conventional strip-mining methods.

**38391 (USGS-OFR—78-1031) Drilling during 1978 in the Danforth Hills coal field, Easton Gulch, Devils Hole Gulch, Axial, and Ninemile Gap quadrangles, Moffat and Rio Blanco Counties, Colorado.** Reheis, M.J. (Geological Survey, Denver, CO (USA)). 1978. 40p. USGS, Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Ten coal test holes, one of which was partly cored by wireline methods, were drilled in 1978. Geophysical logging (single-point resistance, spontaneous potential, natural-gamma, density, and caliper) was carried out. The Survey's drilling program is part of a continuing effort to evaluate the thickness and extent of federally owned coal in the Danforth Hills coal field. Lithologies for rotary-drilled holes were compiled from both the geophysical logs and the descriptions of sample cuttings, except where otherwise noted. In drill-hole D-38-EG, 440 ft were continuously cored by the wireline method; lithologies in this interval were described from the core.

**38392 (USGS-OFR—79-275) Preliminary geologic investigation of the West Glendive lignite deposits, Dawson County, Montana.** Banet, A.C. Jr. (Geological Survey, Denver, CO (USA)). 1979. 135p. USGS, Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Four major lignite beds, all in the Fort Union Formation (Paleocene), occur in the West Glendive area, Dawson County, Montana. The Newton Ranch and Poverty Flats beds are in the Lebo Member and the Peuse and Kolberg Ranch beds are in the Tongue River Member. Correlation of the lignite beds across the area shows that the Peuse bed is the thickest and most extensive. Field mapping and drill-hole data indicate that folding and faulting are more common than previously reported. The data were obtained from oil-well geophysical logs, water-well lithologic logs, geophysical logs provided by Charles M. Hauptman, consulting geologist, Billings, Montana, geophysical and lithologic logs from US Geological Survey-Montana Bureau of Mines and Geology coal drill holes (1978), and the author's field mapping in 1977.

**38393 (USGS-OFR—79-564) Coal geology of the New England-Mott area: Billings, Stark, Slope, Hettinger, and Adams Counties, North Dakota.** Owen, H. (Geological Survey, Denver, CO (USA)). 1979. 311p. USGS, Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

This report on the geology of lignite beds in part of southwestern North Dakota is part of the US Geological Survey's program to map and evaluate the federal coal resources of the Williston basin. Information on the extent, thickness, quality, and correlation of coal beds is presented using data derived from drill-hole geophysical and lithologic logs, coal outcrops, and coal analyses. There are at least nine laterally extensive lignite beds within the Fort Union Formation (Paleocene) in this part of the Williston basin. Each bed is more than 5 ft thick over extensive areas. Generally, the dip is 20 to 30 ft/mi to the northeast. The coal beds that may have the most potential for strip mining are the Coal Bank Creek bed in the vicinity of Havelock, and the Harmon bed near Mott.

**38394 (USGS-OFR—79-762) Content of adsorbed methane in coal from four core holes in the Raton and Vermejo Formations, Las Animas County, Colorado.** Danilchik, W. (Geological Survey, Denver, CO (USA)). 1979. 33p. Geological Survey, Open File Service, Box 25425-Denver Federal Center, Denver, CO.

Gas desorption measurements were made on coal cores collected during the 1978 coal exploratory drilling program at four sites north of the Purgatoire River in the Trinidad coal field, Raton Mesa coal region, Las Animas County, Colorado. Cores of coal beds in the Paleocene and Upper Cretaceous Raton and Upper Cretaceous Vermejo Formations yielded from 23 to 492 cubic feet of gas per ton of coal (0.71 to 15.0 cc/g). The methane content of the gas ranged from 46 to 99%, and the heat of combustion of the gas ranged from 465 to 997 Btu/cf (17,000 to 37,000 kJ/m$^3$). Vermejo Formation coal beds ranging from three to seven feet and totalling as much as 10 feet (3 m) in thickness are believed present beneath an overburden of 1200 to 2200 ft (366 to 670 m) within a 25-square-mile area. Assuming that at least a seven-foot (2 m) thickness of coal extends throughout the area, the volume of gas in-place could be as much as 84 Bcf (2.4 x 10$^9$m$^3$). Coals in this area are known to be gassy, but quantitative data on their adsorbed methane contents are needed to establish whether these coal beds could become a source of pipeline-quality natural gas.

## 0120 Mining

*REFER ALSO TO CITATION(S) 39240, 39457*

**38396 (BEOP—18) National research program on coal. Approved programs for 1982.** (Stichting Energieonderzoek Centrum Nederland, Petten. Bureau Energie Onderzoek). Feb 1983. 105p. (In Dutch). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83750930.

A survey of government-paid and government-supported research on coal is given. Following organizations play an important role in this research program: Universities, Netherlands Energy Research Foundation (ECN), some institutes for Applied Physics Research (TNO), joint electric power generating and distributing organizations (KEMA) and the National Health Institute (RIV). The subjects dealt with are: an overview of the subprograms with necessary extensions; advanced coal mining; wind blown dust during transport and storage; combustion; registration of environmental impact by coal-fired drying plants for greenfood; coal residuals. All these projects are described in detail and the budgets are mentioned.

**38398 (DOE/EV/70003—16) Native or introduced species in mined-land reclamation.** Sindelar, B.W. (Montana State Univ., Bozeman (USA). Dept. of Animal and Range Sciences). 1982. Contract AT06-76EV70003. 4p. (CONF-820281—1). NTIS, PC A02/MF A01. Order Number DE83013030.

From Society for Range Management annual meeting; Calgary, Alberta, Canada (7 Feb 1982).

Research has shown us that both native and introduced plant species are valuable in revegetation and have long been used in range and other cultural practices. Both native and introduced species have more recently been shown to have utility on mined land, especially as revegetation technologies have advanced. This suggests very strongly that the artificial distinction between native and introduced species should be largely disregarded in both theory and practice in mined land reclamation. We must consider each species used in reclamation on its own individual merits, regardless of its place of origin. We must determine how to best use all of the plant materials available to use, includig introduced species–and hybrid crosses of introduced and native species such as those recently developed and tested by Dewey and Asay in Utah. And we need to reexamine the rules and regulations which distinguish between native and introduced species. There have already been changes proposed which would allow use of any plant materials which will achieve the desired goals of specific reclamation plans. Surely the continental origin of a plant species is not as important as its suitability for the purpose at hand.

**38397 (EUR—7869-f) Precautions against coal bumps (Report on ECSC contract 7220-AC/307).** Josien, J.P. (Commission of the European Communities, Luxembourg). 1982. 77p. (In French). Commission of the European Communities, Luxembourg.

The occurrence and mechanism of coal bumps in the mines of Provence, France were investigated. Test holes were used for monitoring of coal bumps, supplemented by continuous monitoring around the worksite by recording the noises emitted during fracture. The effectiveness of destressing by drilling boreholes was also studied. (In French)

**38399 (ORNL/PPA—83/7) Factors affecting lost-time and fatal-injury incidence in US coal mines.** Watson, A.P. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE83013789.

An analysis of major causes of fatal and lost-work-day coal-mine accidents has been performed for the year 1980. Frequency distributions of major causes and their severity were determined, as well as the rate of fatalities, lost-work-day injuries, and lost work days per unit production ($10^6$ tons) and manpower ($10^6$ manhours). These rates were used to derive an estimate of potential fatal and lost-time injuries resulting from supplying projected domestic coal requirements for the year 2020. All primary data were obtained from the Mine Safety and Health Administration of the US Department of Labor, and include all US domestic records for the year of analysis. In summary, this brief analysis has identified the major factors resulting in serious injury and loss of life among underground and surface coal mines in a recent year. The down time and loss of production could be decreased by prompt managerial attention to numerous practical improvements in mine and equipment operation, as well as personal protective equipment. Worker attention to job training and appropriate methods of materials handling are also important.

**38399 (PB—83-171744) Wireless communications for trackless haulage vehicles. Open file report (final).** Cory, T.S. (Cory (Terry S.), Cedar Rapids, IA (USA)). Jul 1979. 165p. NTIS, PC A08/MF A01.

The report describes a complete system design methodology for medium frequency (MF) wireless radio systems for use in coal mines. The emphasis is on AC mines where no trolley wire exists and, for which, conventional trolley phone communications can not be used. The report constitutes an MF system design handbook and includes a compendium of all previous MF technology elements as well as a reference index with abstracts of all pertinent literature. A particular strawman system design analysis is included for the Helvetia Coal Co. Lucerne No. 8 mine in the Upper Freeport seam.

**38400 (PB—83-178244) Constitutive relations of coal and coal measure rocks. Volume I. interrelationship of mechanical, index and geologic properties of coal measure rock. Open file report (final) 1 Jan 75-28 Feb 80.** Barbour, T.G.; Atkinson, R.H.; Ko, H.Y. (Colorado Univ., Boulder (USA). Dept. of Civil, Environmental, and Architectural Engineering). Mar 1980. 112p. NTIS, PC A06/MF A01.

Cores of coal measure rocks from five mines across the United States were tested for mechanical, index, and mineralogic properties. About 600 samples were tested to determine 15 mechanical property parameters, 7 index parameters, and 30 geologic parameters. The results were analyzed for their statistical distributions, and bivariate and multivariate, linear and nonlinear correlations were attempted for these groups. Significant correlations were found for some of the parameters. On the basis of these statistics, predictive models are postulated for the mechanical properties on the basis of index and geologic parameters.

**38401 (PB—83-178251) Constitutive relations of coal and coal measure rocks. Volume II. A study of the orthotropy of coal and other rock materials. Open file report (final) 1 Jan 75-28 feb 80.** Hawk, D.J.; Ko, H.Y. (Colorado Univ., Boulder (USA). Dept. of Civil, Environmental, and Architectural Engineering). Mar 1980. 133p. NTIS, PC A07/MF A01.

The mechanical properties of coal are often represented by the orthotropic material model, which consists of nine elastic constants. The material symmetries involved are found in coal primarily because of the natural process by which the coal was formed. In this report, the material properties of five U.S. coals, as obtained from cubical testing, are examined using the assumption of the orthotropic material model as a basis for comparison. The material properties of two American shales are analyzed, based on the assumption that they comply with the transversely isotropic model. An analysis similar to that performed on the coal material is applied to the shale to determine the conformity of its material properties to the isotropic model.

**38402 (PB—83-178269) Constitutive relations of coal and coal measure rocks. Volume III. Drying shrinkage and creep behavior of coal. Open file report (final) 1 jan 75-28 feb 80.** Tocher, R.J.; Ko, H.Y. (Colorado Univ., Boulder (USA). Dept. of Civil, Environmental, and Architectural Engineering). Mar 1980. 115p. NTIS, PC A06/MF A01.

Uniaxial testing was performed on coal specimens to determine the time-dependent response. The testing was carried out on coal from six mine sites throughout the Western United States and Pennsylvania. Testing configurations were varied to allow analysis of moisture dependency, stress level, and specimen orientation. Several theories were presented for the behavior of coal due to moisture diffusion. Experimental results showed the correlation between the theories and the actual material response. A relationship was developed on the basis of a simplified rheological model to describe the coal response to uniaxial stress. Previous empirical formulations in the form of power laws were compared and their deficiencies pointed out.

38403 **(USGS-OFR—79-226) System-dynamics simulation modeling applied to Western-coal-development environmental-impact analysis.** Mark, R.K.; Harwood, D.S.; Newman, E.B.; Doell, R.R. (Geological Survey, Menlo Park, CA (USA)). Jan 1979. 93p. USGS, Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

This report evaluates the Geological Survey's first attempt to use simulation modeling in the environmental impact statement (EIS) process. It discusses the background of the modeling project, evaluates the usefulness of that project to the Northern Powder River basin regional EIS task force, and recommends procedures for implementing future modeling efforts in regional environmental impact analyses. A system dynamics model (PRB) consisting of industrial, mining, demographic, and land use sectors was produced for the EIS region; the modeling team helped the task force understand the proposed action and alternatives as time series scenarios; several factors limited the usefulness of the modeling project to the EIS task force; the modeling team viewed the model building process as being an important step to understanding causal relations and feedback mechanisms which operate between resource development and environmental impacts (building the model was as important as using the model for environmental impact analysis); communication between the modeling team and the task force was poor; if simulation modeling is used in future regional EIS analyses, the task force must build the models; the model must be viewed as a learning and integrating device to help the task force analyze impacts associated with a broad range of regional resource development options; and the modeling concept is transferrable from region to region, but it is not possible to create a universal model framework to accept data from any region dealing with any resource.

## 0130 Transport And Handling

*REFER ALSO TO CITATION(S) 38395*

38404 **(ACIRL-PR—82-3) Coal preparation - dense media rheology. A review of measurement and control.** Graham, C.C.; Lamb, R. (Australian Coal Industry Research Labs. Ltd., North Ryde). Apr 1982. 52p. Australian Coal Industry Research Labs. Ltd., North Ryde.

This paper details the factors which have a major influence on cyclone dense medium viscosity and stability. It examines the effects of viscosity and stability of dense medium on cyclone operation and efficiency and reviews the design of instruments for the measurement of these properties.

38405 **(DOE/PC/30139—T3) Heavy-liquid beneficiation of fine coal. Final report.** Keller, D.V. Jr.; Simmons, F.J. (OTISCA Industries Ltd., Syracuse, NY (USA)). Mar 1983. Contract AC22-80PC30139. 137p. NTIS, PC A07/MF A01. Order Number DE83013822.

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Heavy-Liquid Benefication of Fine Coal is a multitask, fundamental research program directed towards development of a basic understanding of the rheology of fine-coal/heavy-liquid slurries and methods of obtaining useful rheological data, and the application of this understanding to the development of a heavy-liquid fine-coal benefication pilot test facility utilizing cyclone technology. The project duration was two years beginning October 1980, with a total contract cost of $331,000. The major milestones were identified as: (1) the development of a reliable, accurate method for the measurement of the viscosity of various solid/heavy-liquid slurry systems; (2) a survey of a limited number of organic true-heavy-liquids and the choice of one that was representative of this class of liquids for utilization in this project; (3) the evaluation of the rheology of the coal/heavy-liquid and coal/water/magnetite slurry systems using a matrix of parameters including size distribution, solids concentration and density distribution; (4) the design, construction and testing of a one-ton-per-hour pilot-acale cyclone-based true-heavy-liquid, fine-coal benefication facility; and (5) evaluation of the coal cleaning performance and process economics of the pilot facility as compared to state-of-the-art technology. The first nine months of this effort were devoted to the rheological studies, with an effort over the next six months directed towards the design, construction and evaluation of the heavy liquid cyclone (HLC) pilot facility. 35 figures, 14 tables.

38406 **(DOE/PC/40807—T7) Flow and design characteristics of the hydrocyclone for the recovery of coal fines. Seventh quarterly report, March 1, 1983-May 31, 1983.** Davis, P.K. (Southern Illinois Univ., Carbondale (USA). Coll. of Engineering and Technology). 1983. Contract FG22-81PC40807. 38p. NTIS, PC A03/MF A01. Order Number DE83013393.

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Progress reports are presented for the following tasks; effect of varying the underflow area of the hydrocyclone; data yet to be taken using spheres; presentation of sphere data in a user's manual; purchase and installation of the IBM microcomputer; and additional findings on the separation of coal fines from gob (mineral wastes).

38407 **(FE—3242-5) Laminar flow cyclone development program. Quarterly technical progress report, January 1-March 31, 1979.** Giles, W.B.; Bekofske, K.L. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Apr 1979. Contract AC21-78ET11031. 27p. NTIS, PC A03/MF A01. Order Number DE83013508.

The principal constraint to high Reynolds number operation is due to boundary layer instability in the radial inflow region. Therefore, a model modification has been built to study the influence of inlet wall heating with the water flow model. Analytical investigations of the flow patterns in the cyclone inlet and body are discussed.

38408 **(PB—83-171983) Resilient screen test program. Open file report (final) 25 Jan 80-29 Jan 82.** Wessels, W.R. (Wyle Labs., Huntsville, AL (USA)). Jan 1982. 57p. NTIS, PC A04/MF A01.

This report describes a field survey and laboratory investigation into the causes of failure of resiliently clad screen decks applied to coal preparation plants. Blinding of screen deck perforations and delamination of the resilient cladding are studied and mechanisms responsible for these failure modes are hypothesized. A laboratory test program to simulate the mechanisms was begun and abandoned when it became apparent that meaningful test results would require a substantially redirected effort. No meaningful test data was obtained from the laboratory simulation.

38409 **Preliminary feasibility of coal slurry pipelines in Virginia.** Yuecel, O. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Materials and Society;* 7: No. 2, 137-152(1983).

A preliminary yet realistic feasibility study has revealed that there are no extraordinary technical or environmental problems associated with the conceived Virginia coal slurry pipelines. Both hydraulic transport and cost characteristics appear to indicate a general agreement with previously reported trends.

## 0140 Combustion

*REFER ALSO TO CITATION(S) 38343, 38365, 38370, 38371, 38385, 38395, 38427, 39118, 39280*

38410 **(CONF-830358—20) Coal devolatilization for overbed feed and underbed feed of coal in fluidized-bed combustors.** Lee, Y.Y.; Sarofim, A.F.; Beer, J.M. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). 1983. 43p. Massachusetts Inst. of Tech., Cambridge, MA 02139.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

Both the Underbed and Overbed coal feed systems have been developed to industrial practice and are used in presently installed fluidized combustors. The arguments developed in this paper are based on the premise that the need for feeding the coal at a number of points into the fluidized bed is primarily due to the coal volatiles which may evolve fast after the coal's injection, relative to the dispersion of the coal from a feed point. The purpose of this paper is to provide a quantitative basis for the design of coal feed system by considering the relative rates of coal devolatilization and particle mixing in the bed and the freeboard, as affected by fluidized combustion operating variables. For the underbed feed model

for calculating the oxygen requirement for volatile combustion in the volatile release of the bed has been developed. Three bituminous coals and one lignite were chosen to study the variation of oxygen requirement with coal types. The model is capable of being used for determining whether sufficient oxygen is supplied to the volatile release zone so as to avoid overbed burning of volatiles, and for the design of spacing between coal feed points for different coal types. For the overbed feed a volatile release model for a spreader feeder in the freeboard of a fluidized bed coal combustor has been developed. Particle trajectories, residence times of the particles in the freeboard, and the amount of volatiles released during the period of time were determined for the effects of spreader feeder design parameters and coal feed particle sizes. 14 figures, 4 tables.

38411 **(CSS/CI—83-04) Fate of fuel nitrogen in one-dimensional, subbituminous-coal-dust flames.** Midkiff, K.C.; Peck, R.E.; Altenkirch, R.A. (Kentucky Univ., Lexington (USA). Dept. of Mechanical Engineering). 1983. Contract FG05-82ER75039. 27p. (CONF-830358—14). NTIS, PC A03/MF A01. Order Number DE83012285.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

Experiments on the distribution of fuel nitrogen in two fuel-rich, pulverized-subbituminous-coal/$O_2$/Ar flames stabilized on a flat-flame burner are reported. The gas-phase concentrations of HCN, NO, $NH_3$, $N_2$, and the major species as well as the solid-phase nitrogen content were measured as a function of reaction time. Particle and gas temperature profiles were obtained with an infrared pyrometer. Coal nitrogen evolution is more complete in the leaner flame. NO in the leaner flame and both HCN and NO in the richer flame account for most of the early gas-phase nitrogen, but $N_2$ predominates later in both flames. A rate constant for coal-nitrogen release determined from the solid-phase nitrogen data is presented.

38412 **(CSS/CI—83-08) Thermal auto-ignition of low-heating-value gases by preheating at constant pressure.** Pfefferle, L.; Churchill, S.W. (Pennsylvania Univ., Philadelphia (USA). Dept. of Chemical Engineering). 1983. 16p. (CONF-830358—18). Univ. of Pennsylvania, Department of Chemical Engineering, Philadelphia, PA.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

The ignition characteristics of various low-Btu gas mixtures at constant pressure were determined theoretically using a detailed free-radical kinetic model. Various compositions, equivalence ratios, initial temperatures and uniform rates of heating were investigated. Ignition delay times from 5 to 800 μs were found for initial temperatures ranging from 1200 to 2100°K. Pure methane mixtures were found to be the most difficult to ignite (approx. 800 μs at 1200°K; and phi = 1); however, small additions of either hydrogen or ethane produced a dramatic improvement. Low hydrogen contents and dilution with nitrogen resulted in an increase in the flame spread. The thermally stabilized combustor of Churchill and coworkers appears to be applicable only for those mixtures containing sufficient hydrogen atoms to restrict the flame spread.

38413 **(CSS/CI—83-09) PAH emissions from combustion of coal liquids in industrial furnace.** Schirmer, R.M.; Gill, M.D.; Nickeson, D.A. (Phillips Petroleum Co., Bartlesville, OK (USA); Zink (J.) and Co., Tulsa, Okla (USA)). 1983. 24p. (CONF-830358—10). The Combustion Inst., Central State Section, P.O. Drw. 28510, San Antonio, TX 78284.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

The possible environmental impact of substituting fuel oils derived from coal instead of petroleum was investigated using an industrial furnace. Emphasis was placed on the emissions of polynuclear aromatic hydrocarbons (PAH). The nonpetroleum fuel oil (ECLP-SS) was produced from Texas lignite coal by the Exxon Donor Solvent Process at the Exxon Coal Liquefaction Pilot Plant. The effects of furnace loading and flue-gas temperature on PAH emissions were studied by varying both the firing rate of the burner and the amount of wall insulation in the water-cooled furnace. The research furnace was fully instrumented for measuring the concentration of oxygen, carbon monoxide (CO), and nitrogen oxides (NO/sub x/) in the flue gas. PAH emissions were measured by a special sampling train and analytical method. Seventeen successful test runs were completed using the ECLP-SS, natural gas, and No. 6 fuel oil. Highly luminous flames indicated the formation of carbon particles during the combustion of both fuel oils; however, no visible soot emissions were observed with either fuel oil over the entire range of operation. The very low level of CO emissions indicated complete combustion with all test fuels at all operating conditions, and the calculated combustion efficiencies were 99.9+ percent. As expected, because of its low nitrogen content, NO/sub x/ emissions with ECLP-SS were below the Federal standard for new stationary sources. There are no PAH emission limits in the Federal standards at this time, and none are planned. We used the predominant PAH species of pyrene, benz(a)anthracene, benzo(a)pyrene, benzo(e)pyrene, benzo(b)fluoranthene, and benzo(g,h,i)perylene to indicate total PAH concentration. When compared at the same furnace condition, we found that PAH emissions were not statistically different for the three fuels tested. Therefore, we conclude that the combustion of coal-derived fuel oils should not generate objectionable PAH emissions in industrial furnaces.

38414 **(CSS/CI—83-13) Burning time maps of coal and carbon particles: the diffusional contribution.** Farzan, H. (Kentucky Univ., Lexington (USA)). 1983. 16p. (CONF-830358—12). Combustion Institute, Central States Section, P.O. No. 28510, San Antonio, TX 78284.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

The diffusional components of experimental values of burning times of coal and char particles reported in the literature have been compared with predicted values and shown to have good agreement over a wide range of experimental conditions. Particle sizes ranged from a few microns to 15 mm; reaction temperatures from 800 to 3000°C; and oxygen concentrations from 2% to 100%. Experimental systems included captive and free particles, particles in flames, and particles in fluid beds. Burning times ranged over seven orders of magnitude, from 1 to $10^7$ msec. Ten data sources were reviewed, providing a total of 1100 measurements with 900 measurements coming from a single source. The agreement obtained provide a good basis for the common assumption that the diffusional component of reaction time can be calculated with acceptable accuracy with some reservations in special circumstances. 1 figure, 1 table.

38415 **(DOE/ET/10679—T17) Pulverized-coal combustion. Final report.** Singer, S. (Engineering Societies Commission on Energy, Inc., Washington, DC (USA)). Apr 1983. Contract AC22-77ET10679. 194p. (FE—2468-103). NTIS, PC A09/MF A01. Order Number DE83013544.

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This report presents the results of a review of basic problems in use of pulverized coal, emphasizing basic engineering and scientific studies which have been published. The goal has been to provide a summary of the current knowledge of this field. Research laboratories at universities, non-profit technical institutions, government establishments, and industrial engineering centers have engaged in a program of investigations of pulverized-coal combustion and related problems under the cognizance of the Department of Energy's Pittsburgh Energy Technology Center. A review of this program has also been made and is a part of this report. In addition to an evaluation of the specific research studies in the program, its overall content and organization have been examined with respect to the problem areas identified in the general review of the field. The major subjects which have been covered include the properties of the fuel, its chemical composition, particle properties in the sizes involved (0 to 100 μm), and the pore structure of the solid. The combustion characteristics of the fine-particulate coal are discussed, as are heat transfer, the substances given off when coal is heated, and the reactions of combustion. Formation of pollutants, soot, and ash from combustion of coal is reviewed. These areas present continuing problems in the practical applications of pulverized coal. A comparison of the current status of problems in the field with the PETC program has been made. The PETC pulverized-coal research program has a diversity of individual investigations that fall in significant problem areas identified in the assessment of the cur-

rent field. These investigations utilize advanced methods and are producing information applicable to major current problems. Recommendations, contingent on other program considerations, are made to include additional studies in selected areas of particular significance. 13 figures, 6 tables.

38416 **(DOE/FE/60181—16) Heat transfer to horizontal tubes in a pilot-scale fluidized-bed combustor burning low-rank coals.** Grewal, N.S.; Goblirsch, G. (North Dakota Univ., Grand Forks (USA). Dept. of Mechanical Engineering; USDOE Grand Forks Energy Technology Center, ND). 1983. Contract FC01-83FE60181. 11p. (CONF-830702—19). NTIS, PC A02/MF A01. Order Number DE83013246.

From 21. ASME/AIChE national heat transfer conference; Seattle, WA, USA (24 Jul 1983).

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Experimental data are obtained for the heat transfer coefficient between immersed horizontal tube bundles and an atmospheric-fluidized-bed combustor burning low-rank coals. Silica sand (d/sub p/ = 888 to 1484 μm) and limestone (d/sub p/ = 716 to 1895 μm) are used as bed material. The tests are conducted, with and without limestone addition and ash recycle, at average bed temperatures ranging from 1047 to 1125°K, superficial fluidizing velocity of 1.66 to 2.04 m/s, and excess air levels of 15 to 40 percent. The experimental data are examined in the light of the existing correlations for the heat transfer coefficient. The predicted values of heat transfer coefficient from the correlations proposed by Grewal (1981) and Bansal et al. (1980) are found to be within +-25 percent of the experimental values of heat transfer coefficient, when the contribution due to radiation is also included. 5 figures, 5 tables.

38417 **(DOE/PC/40265—7) Computational tools for pulverized-coal combustion. Seventh quarterly report, October 1982-December 1982.** Oberjohn, W.J.; Cornelius, D.K.; Fiveland, W.A. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). May 1983. Contract AC22-81PC40265. 26p. (ARC—5280). NTIS, PC A03/MF A01. Order Number DE83013058.

The combustion model (COMO) consists of a number of relatively independent modules that represent the major processes involved in pulverized-coal combustion. These modules will be continually upgraded over the course of the contract. During the first quarter, detailed life-of-the-project task descriptions were prepared, literature searches were conducted, and process models were selected. In the second quarter, formulation and coding of the initial gas-phase turbulence, chemistry and radiation models were completed. During the third quarter, COMO predictions for both swirling and nonswirling isothermal flow were compared to proprietary data and predictions; these were found to be in agreement. During the fourth quarter, evaluation of the fast-kinetics micromixing model continued. The radiative properties of coal, char, and ash were defined, based on recommended values of the refractive indices. During the fifth quarter, the definition of the solid-phase models was completed, and coding was initiated. During the sixth quarter, coding of the solid-phase models was completed and the individual models were tested for consistency. The models were then combined to form an integrated solid-phase combustion model. The COMO predictions have been compared to Brigham Young University's two-dimensional, pulverized-coal combustion model for a one-dimensional test case and good agreement was obtained. During this quarter, an evaluation run for nonswirling pulverized-coal combustion was initiated. Efforts this quarter have concentrated on integrating modules to execute a pulverized-coal combustion case. The case is not yet complete; results and comparisons will be presented in a subsequent report. 4 figures, 3 tables.

38418 **(DOE/PC/40270—4) Combustion-enhancement and pollutant-control research with acoustically induced mixing. Final report.** Faeser, R.J.; Rudnicki, M.I. (Aerojet Energy Conversion Co., Sacramento, CA (USA)). Mar 1983. Contract AC22-81PC40270. 70p. NTIS, PC A04/MF A01. Order Number DE83011447.

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The application of acoustic energy to a pulverized-coal flame was investigated to determine its influence on NO/sub x/ generation, combustion intensity and turndown ratio. A bench-scale, research combustor utilizing plug flow and burning 5 lb/hr of Illinois No. 6C coal was tested as both a two-stage and single-staged combustor with and without acoustics applied. Sound intensities up to 149 dB at frequencies from 1100 Hz to 3000 Hz were evaluated. The experiments showed that NO/sub x/ generation was unaffected by acoustic mixing in the low first-stage stoichiometric ratio ($SR_1$) range of a two-staged combustor and increased up to 20% by use of acoustics in the high $SR_1$ range. A similar increase in NO/sub x/ with acoustics was seen in a single stage combustor operating with 5% to 20% excess air. The testing further showed that carbon burnup efficiency could be increased by 7 to 9 percentage points (in the 90 to 100% range) when acoustics were applied. Limited test data indicated that volumetric heat release and turndown ratio could be increased by a factor of 2.8. 21 figures, 3 tables.

38419 **(DOE/PC/40796—6) Carbon attrition during the fluidized combustion and gasification of coal. Quarterly technical progress report, 1 December 1982-28 February 1983.** Massimilla, L.; Arena, U.; Cammarota, A.; Chirone, R.; D'Amore, M.; Farina, B. (Naples Univ. (Italy)). 1983. Contract FG22-81PC40796. 20p. NTIS, PC A02/MF A01. Order Number DE83013085.

The generation and elutriation of attrited carbon fines during the fluidized combustion of a metallurgical coke has been investigated by means of a 140 mm ID fluidized bed combustor. The influence of a number of design and operational variables of the combustor, including feed coke particle size, bed temperature, bed height and excess air factor, has been tested. The relationships between attrited carbon rates and bed carbon loading and exposed surface have been outlined, and compared with those previously found under similar experimental conditions burning a coal. 8 figures, 2 tables.

38420 **(DOE/PC/40796—7) Carbon attrition during the fluidized combustion of coal. Quarterly technical progress report, 1 March-31 May 1983.** Massimilla, L.; Borriello, L.; Cammarota, A.; Chirone, R.; Mazza, A. (Naples Univ. (Italy)). 1983. Contract FG22-81PC40796. 31p. NTIS, PC A03/MF A01. Order Number DE83013086.

The work during the period 1 March-31 May 1983 has been directed to test fragmentation and attrition occurring during the fluidized combustion of two English coals: marine Welsh Coking Coal and Snibston Bituminous Washed Single Coal, both supplied by National Coal Board, U.K. Time-resolved bed carbon loading and particle size distributions, and instantaneous carbon attrition rates have been determined in batch fluidized combustion experiments using laboratory scale apparatus and techniques described in DOE Reports No DOE/PC40796-1 and 2. Correlations between carbon attrition rates and bed carbon exposed surfaces provide attrition rate constants. Results for the two coals are compared with each other and with the results obtained with the South African coal previously tested. 16 figures, 2 tables.

38421 **(DOE/PC/50261—T2) Investigate the effectiveness of calcium-treated coals in the capture of sulfur gases generated in staged fired combustors. Second quarterly technical progress report, January 1, 1983-May 1, 1983.** Porter, J.H.; Manning, M.P.; Benedek, K.R.; Sharma, P.K. (Energy and Environmental Engineering, Inc., Cambridge, MA (USA)). 1 Jun 1983. Contract AC22-82PC50261. 36p. NTIS, PC A03/MF A01. Order Number DE83012341.

The objecties of this program are threefold: (1) to develop and test methods to fix calcium ions into the coal matrix; (2) to determine the effectiveness of sulfur capture by calcium treated coals as a function of coal type, calcium fixation method, coal particle size, combustion temperature, equivalence ratio and particle residence time; (3) to develop a model of sulfur capture by calcium treated coals which will describe the dependence of sulfur retention on the above mentioned experimental parameters. To meet these objectives, the research program has been divided into the following six tasks: (1) literature review and coal selecton; (2) design and construction of test facilities; (3) development of calcium fixation procedures; (4) pretreating coal for combustion study; (5) experi-

mental investigation of sulfur capture; and (6) model development. In this quarter's work, progress was made toward the completion of two tasks: the calcium impregnation studies and the design and construction of the combustion apparatus. 8 figures, 6 tables.

**38422 (DOE/PC/50266—3) Vaporization and devolatilization of coal-water sprays. Third quarterly report for the period ending May 11, 1983.** Chigier, N.; Meyer, P.L. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Mechanical Engineering). 11 May 1983. Contract FG22-82PC50266. 27p. NTIS, PC A03/MF A01. Order Number DE83013586.

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The objective of this research is to investigate fundamental processes leading to combustion of coal-water slurries. The research is focused in two main areas: the vaporization of water from a coal-water slurry spray and the devoltailization of the coal particles in the spray. Work this past quarter has centered on preparing and installing the major pieces of equipment for the coal-water slurry (CWS) spray test facility. The system is nearly complete except for the coal-water slurry, atomizing, and secondary air lines. The first 500-gallon shipment of 70%-by-weight CWS was received from Atlantic Research Corporation. A study of atomizer designs used in coal-slurry spray and combustion tests has also been completed. A summary of the test conditions and operating experiences is presented. 17 figures.

**38423 (EUR—7844-e) Production of steam for electricity generation or other uses from high-ash coals using fluidized bed combustion techniques (Report on ECSC contract 7220-EC/881).** (Commission of the European Communities, Luxembourg). 1982. 14p. Commission of the European Communities, Luxembourg.

The feasibility of burning a low grade Irish coal using the atmospheric fluidized bed combustion technique was investigated. Tests were carried out in plants varying from a laboratory rig to a demonstration plant. The test programme was overall successful and resulted in the issuing of an enquiry specification for a commercial unit.

**38424 (ORNL/TM—8735) Hot-corrosion reactions of calcium sulfate with Cr, Ni, Co, Fe, and several alloys.** Ficalora, P.J. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 41p. NTIS, PC A03/MF A01. Order Number DE83013715.

When coal is burned in the presence of limestone in an atmospheric fluidized-bed combustor (AFBC), the sulfur emission can be kept below acceptable Environmental Protection Agency levels. Calcining the limestone produces CaO, which then forms solid $CaSO_4$ by a reaction with the $SO_2$ produced during coal combustion. The internal components (e.g., heat exchanger tubes) of the bed, however, become coated with a compact layer of $CaSO_4$, CaO, and ash during combustion. The presence of the sulfate on these hot metal surfaces is a suggested cause of observed instances of accelerated oxidation-sulfidation. This paper presents results that support this suggestion. The reactions between Cr, Ni, Co, Fe, alloy 800, 2 1/4 Cr-1 Mo and 9 Cr-1 Mo steels, and type 304 stainless steel with $CaSO_4$ were studied by differential thermal and thermogravimetric analysis of metal-sulfate powders. The reaction products were analyzed by x-ray diffraction, optical microscopy, and in some instances x-ray energy-dispersive analysis. The chromium-calcium sulfate reaction is the only case studied in which a sulfide is not formed. In that case, $CaCr_2O_4$ is the reaction product and may serve as a means for corrosion reduction in an AFBC. In all other cases, the reactions are oxidation-sulfidation processes.

**38425 High temperature material degradation in fluidized-bed coal combustion.** Bach, P.W. Petten, Netherlands; Stichting Energieonderzoek Centrum Nederland (1983). 74p. (In Dutch). (ECN—83-062). Available from ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

This report, after a description of the fluidized-bed combustion process, treats the thermodynamics and kinetics of corrosion, the important high temperature corrosion phenomena, the interaction between corrosion and the mechanical properties and the erosive degradation of metals.

## 0150 Marketing And Economics

*REFER ALSO TO CITATION(S) 39453*

**38426 (DOE/EIA—0206(81)) Performance profiles of major energy producers 1981.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Jun 1983. 173p. NTIS, PC A08/MF A01. Order Number DE83013566.

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The purpose of this publication is to examine year-to-year developments in the operations of 26 major US energy companies on a corporate level, and also by major line of energy business and by major functions within each line-of-business. This report presents data collected for calendar year 1981. Although the focus is on developments in 1981, important trends over the 1974 to 81 period are also featured. Contents ae as follows: (1) energy market in 1981; (2) overview of investment and profits; (3) domestic petroleum developments; (4) foreign petroleum developments; (5) coal, nuclear, and other energy; (6) nonenergy; and (7) appendixes.

**38427 (FE—2517-4) Portfolio selections for fossil demonstration-plant programs. Executive summary. Econergy report No. 1-705.** English, J.M.; Smith, J.L.; Grant-Smith, S.G. (Econergy, Inc., Los Angeles, CA (USA)). Mar 1977. Contract AC01-76ET12316. 42p. NTIS, PC A03/MF A01. Order Number DE83013456.

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A unique methodology has been developed by Econergy for evaluation and selection of a set of proposed coal-conversion processes. By incorporating the fundamental principles of portfolio theory, both the risks and economic benefits - revenues less costs of capital, operation, and time - can be determined for a set of processes. The trade-off between benefits and risks for each possible set of coal-conversion processes is illustrated by examining their relative positions on a benefit-risk map in relation to a decisionmakers's risk-attitude function.

**38428 (VPI/CER—3902430) Virginia coal production: impacts and projections.** Hibbard, W.R. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Virginia Center for Coal and Energy Research). 1 Jun 1983. 13p. NTIS, PC A02/MF A01. Order Number DE83902430.

Virginia's coal sales have been largely for metallurgical (coking) applications. The met coal market is facing a serious decline. Those suppliers with long-term contracts believe they will not be affected unless force majeure (coercive power) is imposed. Long-term projections, based on a worldwide recovery of the steel industry and the changing technology and economics of steel making, suggest that future sales will be flat. Based on studies of market trade-preferences, evidence suggests that Australia will displace the Unted States as the leading exporter of met coal. The possible requirement that US coal-burning utilities reduce sulfur dioxide effluents may lead to met coal being burned in steam boilers as a measure to avoid installing the more costly flue-gas scrubbers. This requirement, if it becomes law, would improve sales prospects for the central Appalachian coal market. Coal slurries to replace fuel oil in commercial and utility boilers and clean fine coal for chemical feed stocks are other potential new markets totaling 200 million tons per year. In any event, the Virginia coal market is presently an erratic buyers market with more production capacity than demand, and a growing sensitivity to prices resulting from the unstable world economic situation. Our coal suppliers, because of rising mine, railroad, port, and shipping costs, now charge the highest worldwide delivery prices which will make Virginia a residual supplier and possibly vulnerable to more foreign imports. A coal slurry pipeline which will reduce the delivered cost of Virginia's coal and make it more competitive with eastern Kentucky and southern West Virginia coal, of similar quality, will assist the state in maintaining its market share as the market recovers. Although it will not increase the world-market share exported from Hampton Roads, it may increase Virginia's share of that market from 22.8% to 50%.

**38429 Virginia metallurgical coal production and exports: a prospects update.** Hibbard, W.R. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Materials and Society;* 7: No. 2, 173-182(1983).

This study attempts to identify and evaluate the various factors affecting the met coal market and provides an estimate delineating the Virginia market to the year 2000. It is projected to increase by up to 20 percent as low sulfur, low ash met coal is used as a replacement by electric utilities both here and abroad. This expansion could be further influenced by control regulations, resulting from the current reappraisal of the Clean Air Act, and a narrowed price differential between met and steam coal as an advanced steelmaking technology reduces the requirement for coke. Other new markets include those for fine clean coal slurries (with oil, methanol or water) to replace fuel oil in commercial and utility boilers, and fine clean coal used as chemical feed stocks and to replace anthracite. These new (non metallurgical) markets for met coal could total 500 million tons by the year 2000.

### 0160 Health And Safety

*REFER ALSO TO CITATION(S) 38398, 39453*

**38430 (DOE/PC/42692—T2) Exploratory research on mutagenic activity of coal-related materials. Final report, October 1, 1981-December 28, 1982.** Warshawsky, D.; Schoeny, R.S. (Cincinnati Univ., OH (USA). Kettering Lab.). 1982. Contract AC22-81PC42692. 50p. NTIS, PC A03/MF A01. Order Number DE83012791.

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Samples for mutagenicity assay were obtained from the EPA/DOE Fossil Fuels Research Materials Facility at Oak Ridge. They included shale oil, petroleum crudes, syncrude oil and H-coal process materials. No sample tested was mutagenic for any Salmonella strain in the absence of S9 for metabolism. TA98 was most responsive to the mutagenic activity of these materials followed by TA1538 and TA100. The vacuum bottoms (fuel oil mode) reverted TA1537 to the same extent as TA100, indicative of the presence of material similar to acridine. Results of testing of whole samples were in good agreement with sums of weighted fractional activities published by Guerin et al. (1981). H-coal vacuum bottom samples from two modes of operation were similar to DOE experimental H-coal process samples (ETTM-11 and ETTM-18) in these respects: (1) mutagenicity of the whole sample, (2) distribution of components into fractions by organic solvents, and (3) mutagenicity of specific fractions. Methods were developed to analyze for polycyclic aromatic hydrocarbons and their heterocyclic aromatic analogs in solvent-extracted fractions of H-coal materials using a combination of neutral alumina and high performance liquid chromatography (HPLC) and fluorescence spectroscopy techniques. The neutral alumina chromatography, a necessary precursor to HPLC, increased the longevity of /sup C/18 reverse column and improved the peak resolution of HPLC chromatograms. The HPLC chromatograms of five H-coal hexane and toluene-extracted fractions showed prominent peaks with retention times of 7.5 and 11.5 minutes and a large group of peaks from 18 to 24 minutes. HPLC retention times and fluoresence spectra were used to identify pyrene at 11.5 minutes and tentatively identify tryphenylene and chrysene at 16 and 18 minutes, respectively. Additional HPLC separations and mass spectral analyses are planned. 3 figures, 24 tables.

**38431 (NILU-TR—15/18) Determination of human exposure using measured data on Cd, As and Pb.** Pacyna, J.M.; Sivertsen, B. (Norsk Inst. for Luftforskning, Kjeller). Dec 1981. 22p. Norsk Inst. for Luftforskning, Kjeller.

The dietary intake and human exposure of Cd, Pb and As were estimated based upon data taken near a coal-fired power plant in Poland. The use of compartment models for estimating total human exposure has been demonstrated, and values of transfer factors were compared with data from the literature. (2 drawings, 15 tables)

**38432 (PB—83-179820) Effects of a fan shutdown on radon concentration in a positive pressure ventilated mine. Report of investigations/1982.** Musulin, C.S.; Franklin, J.C.; Roberts, F.A. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). Jan 1983. 16p. NTIS, PC A02/MF A01.

The Bureau of Mines conducted an experiment at Exxon Mineral Co.'s Buffalo Shaft Operation to determine the time required for radon concentrations to return to a base average after fan shutdowns. Shutdown times ranging from 5 min to 16 hr were evaluated. An equation was derived to calculate a ratio that determines the time required for the radon concentration to return to the average level that existed in the mine prior to shutdown.

**38433 Respirable aerosols from fluidized bed coal combustion. 3. Elemental composition of fly ash.** Weissman, S.H.; Carpenter, R.L.; Newton, G.J. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *Environmental Science and Technology;* 17: No. 2, 67-71(Feb 1983). Contract AC04-76EV01013.

Fluidized bed coal combustion is a promising technology for using coal in an environmentally acceptable manner. Trace elemental constituents in fly ash from an experimental atmospheric pressure fluidized bed combustor (AFBC) are reported and compared with pulverized-coal combustor (PCC) ash data and those from other fluidized bed combustors. Bulk and size-separated particles were collected and analyzed by using spark source mass spectrometry.Fluidized bed combustor ash was similar to PCC ash in minor and trace element composition. However, AFBC ash showed less size dependence of elemental composition than has been reported for PCC ash. Bulk particle elemental composition varied with sampling position within the effluent stream. Penetration of elements through each cleanup stage and elemental enrichment were a function of the cleanup stage and the element under consideration.

**38434 Probabilistic risk analysis methods for the coal fuel cycle.** Morris, S.C. (Brookhaven National Lab., Upton, NY). pp 109-114 of Probabilistic risk assessment. La Grange Park, IL; American Nuclear Society, Inc. (1982). (CONF-810905—).

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

A Monte Carlo approach was used to estimate health damage in the coal fuel cycle, including mining, cleaning, transport, and electric power generation. Both classical statistical techniques and judgmental values were used as appropriate to derive probability density functions for health damage functions. Scientific and locational uncertainty were considered. The results are ~18 deaths/GW/sub e/-y for the total fuel cycle with an 80% confidence interval of 2-45. The upper tail particularly is dominated by air pollution estimates. Elimination of locational uncertainty and assumption of a threshold for air pollution effects reduces the median estimate to ~4 deaths/GW/sub e/-y with an 80% confidence interval of 3-6.

## 02 PETROLEUM

### 0201 Reserves

**38435 (USGS-OFR—82-37) Estimated oil and gas reserves, Southern California Outer Continental Shelf, December 31, 1981.** Kalil, F.F. (Geological Survey, Denver, CO (USA)). 1982. 10p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

Remaining recoverable reserves of oil and gas in the Outer Continental Shelf off Southern California are estimated at approximately 861 million barrels of oil and about 1733 billion cubic feet of gas, as of December 31, 1981. Reserves for a new field, Point Arguello, that was discovered during 1981 are not included in these estimates, as available data are not sufficient to allow a reasonably accurate estimate of reserves at the present time. Original reserves of the 13 known fields are estimated at about 1082 million barrels of oil and 1847 billion cubic feet of gas. The estimates for both the remaining and the original reserves of oil are higher, but those of

gas are lower, than the corresponding December 31, 1980, estimates for the same fields. Reserves estimates for 11 fields were based on individual volumetric reservoir studies. Decline-curve and volumetric analyses were used to estimate the reserves for the remaining two fields. By the end of 1981, five fields were on production and two more were scheduled to start producing during 1982. 2 figures, 1 table.

## 0202 Geology And Exploration

*REFER ALSO TO CITATION(S) 39457*

38436 **(N—8314628) Remote sensing applications to the development of an integrated data base for oil and gas exploration.** Hall, R.J. (ESL, Inc., Sunnyvale, CA (USA)). Jun 1982. 4p. NTIS, PC A11/MF A01.

Techniques employed in oil and gas exploration and the utility of satellite data to the exploration process are discussed. The application of satellite information to geologic analysis, planimetric mapping and other data collection efforts associated with the search for oil and gas are considered. Geographic information and image processing features that were utilized in three projects are outlined and the potential of data sources such as LANDSAT-D is assessed. Experience shows that satellite imagery is of greatest benefit when it is integrated into a comprehensive data base with conventional data.

38437 **(USGS/MAP/MF—1044B) Map of prospective hydrocarbon provinces of the world: Europe, West Asia, and Africa.** Coury, A.B.; Hendricks, T.A. (Geological Survey, Reston, VA (USA)). 1978. 17p. Geological Survey, 1200 South Eads St., Arlington, VA 22202.

This present work depicts areas, both onshore and offshore, that either contain known oil or gas deposits or that are favorable for their occurrence. These areas consist mostly of basins containing unmetamorphosed sedimentary rocks of greater than 1000 meters thickness. Also included are some platforms and uplifts, foldbelts, and thinner rock sequences. Where the offshore limits of a basin were not known, the 200 or 2500 meter isobaths were used as a boundary.

38438 **(USGS-OFR—78-1020) Hot deep origin of petroleum: deep basin evidence and application.** Price, L.C. (Geological Survey, Denver, CO (USA)). 1978. 110p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

Use of the model of a hot deep origin of oil places rigid constraints on the migration and entrapment of crude oil. Specifically, oil originating from depth migrates vertically up faults and is emplaced in traps at shallower depths. Review of petroleum-producing basins worldwide shows oil occurrence in these basins conforms to the restraints of and therefore supports the hypothesis. Most of the world's oil is found in the very deepest sedimentary basins, and production over or adjacent to the deep basin is cut by or directly updip from faults dipping into the basin deep. Generally the greater the fault throw the greater the reserves. Fault-block highs next to deep sedimentary troughs are the best target areas by the present concept. Traps along major basin-forming faults are quite prospective. The structural style of a basin governs the distribution, types, and amounts of hydrocarbons expected and hence the exploration strategy. Production in delta depocenters (Niger) is in structures cut by or updip from major growth faults, and structures not associated with such faults are barren. Production in block fault basins is on horsts next to deep sedimentary troughs (Sirte, North Sea). In basins whose sediment thickness, structure and geologic history are known to a moderate degree, the main oil occurrences can be specifically predicted by analysis of fault systems and possible hydrocarbon migration routes. Use of the concept permits the identification of significant targets which have either been downgraded or ignored in the past, such as production in or just updip from thrust belts, stratigraphic traps over the deep basin associated with major faulting, production over the basin deep, and regional stratigraphic trapping updip from established production along major fault zones. 21 figures, 8 tables.

38439 **(USGS-OFR—78-1021) Hot deep origin of petroleum: shelf and shallow-basin evidence and application.** Price, L.C. (Geological Survey, Denver, CO (USA)). 1978. 72p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

Oil and gas pools in shallow basins or on the shallow, stable shelves of deeper sedimentary basins may not be exceptions to the model of a hot deep origin of petroleum. The oil in shallow basins is directly associated with faulting extending out of the deepest parts of the basin. Evidence exists that some of these shallow basins have been much hotter in the past either from igneous activity or from a higher geothermal gradient. Uplift and erosion may also have removed substantial thicknesses of sediments in some of these basins. Oil on the stable shallow shelves of deep basins may have originated in the deeper part of the basin and undergone long lateral migration to the traps where it is now found. Conduits for such migration have been sandstones in delta-distributary systems (eastern Oklahoma and Kansas), reef trends (Alberta, Canada), or regional porosity and permeability in sheet carbonates (Anadarko basin, western Oklahoma and Kansas). The model applied herein allows us to (1) predict which areas of the stable shelves of deep basins should produce hydrocarbons and which areas should not; (2) predict the type of hydrocarbon (gas or oil); (3) set the limit of lateral updip migration of hydrocarbons within any one formation in a basin; and (4) predict the downdip occurrence of hydrocarbons in the formation. The model should also help us determine which shallow cratonic basins should produce oil and which should not. 23 figures, 1 table.

38440 **(USGS-OFR—79-201) Bibliography for map of prospective hydrocarbon provinces of the world.** Coury, A.B. (Geological Survey, Denver, CO (USA)). 1979. 90p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

This bibliography includes the references that were used in the preparation of the Map of Prospective Hydrocarbon Provinces of the World. The map is published in three sheets as Map MF 1044 A, North and South America by A.B. Coury, T.A. Hendricks, and T.F. Tyler; Map MF 1044B, Europe, West Asia, and Africa by A.B. Coury and T.A. Hendricks; and Map MF 1044C, East Asia, Australia, and the Pacific by A.B. Coury and T.A. Hendricks. An interrupted Sinusoidal equal area projection was used for the maps to facilitate areal comparisons; the scale is 1:20,000,000. The maps depict areas, both onshore and offshore, that either contain known oil or natural gas deposits or are favorable for their occurrence. These areas consist mostly of basins containing unmetamorphosed sedimentary rocks of greater than 1000 m thickness. Also included are some platforms and uplifts, foldbelts, and thinner rock sequences. The bibliography consists of three sections: (1) selected unpublished sources; (2) author index; and (3) geographic index. The selected unpublished sources and the author index are arranged alphabetically according to the senior author's last name. The geographic index is arranged by continents or subcontinents, followed by minor geographic units, i.e. countries, regions and bodies of water. The references are arranged alphabetically by author within each geographic unit. When a reference covers several geographic areas, it is appropriately cross-referenced in the geographic index. Publications of foreign ministries or bureaus are listed under the respective country, with that country's name spelled in English style.

38441 **(USGS-OFR—79-295) Petroleum-source potential of rocks dredged from the continental slope in the eastern Gulf of Alaska.** Plafker, G.; Claypool, G. (Geological Survey, Menlo Park, CA (USA)). Jan 1979. 25p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

A bedrock dredging program by the R/V Sea Sounder in 1977 and 1978 along the continental slope in the eastern Gulf of Alaska revealed a previously unknown Eocene sedimentary sequence that includes argillaceous rocks with favorable petroleum source rock characteristics. Seven of 36 dredge hauls that sampled outcrop contain argillaceous rocks with more than 1 percent and as much as 1.64 percent organic carbon. Some of the rocks in samples of probable early Eocene age have undergone a thermal history that has resulted in generation of hydrocarbons. The organic matter

appears to be hydrogen deficient, however, which could indicate that the rocks are more likely to be a source of gas rather than liquid hydrocarbon, unless the hydrogen loss is due to weathering. The Eocene rocks are associated with sandstone and conglomerate on the continental slope. They dip northward beneath younger Tertiary strata in the outer continental shelf where they could be an important petroleum source and exploratory target. 4 figures, 5 tables.

38442 **(USGS-OFR—79-400) Summary of petrographic data of basement-rock samples from oil wells in the southeastern San Joaquin Valley, California.** Ross, D.C. (Geological Survey, Menlo Park, CA (USA)). 1979. 24p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

The well data indicate a rather large area of volcanic greenschist associated with lesser carbonaceous schist, amphibolite, and gabbro. These rocks, which are dominantly sodic plagioclase, chlorite, actinolite, and epidote, are in marked contrast to the andesine, hornblende, biotite, and quartz-bearing metamorphic rocks of the surface outcrop areas. The subsurface metamorphic rocks may be related to the Pampa schist, but there are some significant differences. For instance no andalusite has been seen in the subsurface samples, yet andalusite hornfels is common and abundant in the westernmost outcrops of Pampa schist. In short the volcanic greenschists of the subsurface have no surface outcrop equivalents at this latitude. 5 tables.

## 0203 Drilling And Production

*REFER ALSO TO CITATION(S) 38373, 38471, 39477*

38443 **(DOE/BC/10331—9) Displacement of oil by carbon dioxide. Second annual report, October 1980-September 1982.** Orr, F.M. Jr.; Taber, J.J. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Jun 1983. Contract AS19-80BC10331. 118p. NTIS, PC A06/MF A01. Order Number DE83013815.

Results of a comprehensive research effort to investigate and quantify factors which affect the performance of $CO_2$ flood processes in reservoir rocks are presented. An apparatus is described in which displacement of oil from pore networks etched in glass by $CO_2$ at high pressure can be observed visually. Results of a series of secondary and tertiary, first contact and multiple contact miscible displacements are reported. Equipment for on-line measurements of mixing in one- and two-phase displacements is described. A new device designed to separate oil and water continuously in a chamber of very low dead volume is also described. Results of one- and two-phase displacements which validate the experimental techniques are reported. Results of a series of PVT experiments to study the effects of changing both the amount of dissolved gas in a crude oil and the system temperature are given. Those results suggest strongly that the extrapolated vapor pressure of $CO_2$ is a good estimate of the minimum miscibility pressure if the temperature is below about 140°F. Modifications and improvements to the design of the continuous multiple contact apparatus are described, as are preliminary tests of the use of an oscillating quartz crystal to measure viscosities. Results of a series of phase composition measurements to study effects of oil composition on component partitioning in $CO_2$-crude oil systems are reported.The theory of the effect of $CO_2$-crude oil phase behavior on displacements in an ideal porous medium is tested by predicting the performance of slim tube displacements from independently measured phase behavior and fluid property data obtained with the continuous multiple contact experiment. The quantitative agreement between prediction and experiment is good enough to suggest that the essentials of $CO_2$-crude oil phase behavior can be modeled with a small number of pseudo-components.

38444 **(DOE/MC/16551—6) Enhanced oil recovery by $CO_2$ foam flooding. First annual report.** Patton, J.T. (New Mexico State Univ., Las Cruces (USA). Dept. of Chemical Engineering). Jun 1983. Contract AC21-81MC16551. 87p. NTIS, PC A05/MF A01. Order Number DE83013818.

The objective is to identify commercially available additives which are effective in reducing the mobility of carbon dioxide, $CO_2$, thereby improving its efficiency in the recovery of tertiary oil, and which are low enough in cost to be economically attractive. During the past year significant progress has been made in developing a commercial method of reducing the mobility of carbon dioxide in enhanced oil recovery processes. Interest in the industry is high and several companies have agreed to underwrite a portion of funding necessary to continue the research over the next two years. Experiments on gas mobility control, conducted in linear sand-pack models, show only a general correlation with the static foam test. In general, all surfactants that produce reasonable quantities of foam in the blender test also impart some degree of mobility control to gas during two-phase flow. The best mobility control additives however, are only modest foam volume producers. In addition, the best additives spontaneously produce a viscous foam under flow conditions present in a petroleum reservoir. Three basic chemical structures listed below appear to show most promise for gas mobility control: (1) ethoxylated adducts of $C_8$-$C_{14}$ linear alcohols, (2) sulfate esters of ethoxylated $C_8$-$C_{16}$ linear alcohols, (3) low molecular weight co-polymers of ethylene oxide and propylene oxide.Each of the above types are compatible with normal oil field brines, unaffected by the presence of crude oil and stable under conditions common in a petroleum reservoir. Additive stability is of real concern. Limited experimentation suggests that only the sulfate esters might degrade at an unacceptable rate. This could limit their application to lower temperature reservoirs. No degradation was noted for structures 1 and 3 in aging tests lasting 2 weeks at 125°F. 15 figures, 4 tables.

38445 **(DOE/NBM—3012985) Joint characterization of heavy crude oils, Annex I. Venezuela-MEM/USA-DOE fossil energy report I-1.** Good, W.D.; Lubkowitz, J. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center; INTEVEP, Filial de Petroleos de Venezuela, SA, Caracas). Apr 1983. 41p. NTIS, PC A03/MF A01. Order Number DE83012985.

The agreement between the United States and Venezuela was designed to further energy research and development in six areas. This report focuses on Annex I - The Joint Characterization of Heavy Crude Oils. Annex I has separated this portion of the cooperative energy research and development effort into three tasks for study. Research into the characterization of heavy oils has as its goals (1) the determination of data that can be utilized in developing correlations for processing of heavy oils, and (2) the development of new or modification of old analytical techniques to acquire these data. One of the critical problems requiring considerable research concerns the timely developments of methodology to acquire data. Although mass spectrometry, NMR, and other analytical methods have enjoyed some success in analyzing materials below 600 molecular weight, applications to higher molecular weight materials has not been satisfactory. This cooperative project examines both the lower boiling range materials with currently known and improved techniques and then higher boiling range materials with methods developed in joint efforts of both countries. Data generated through these efforts will be later integrated into process correlations for heavy oils such as the oil under present study: Cerro Negro from the Orinoco Oil Belt.

38446 **(DOE/SF/01424—48) Multi-pattern low-tension demonstration flood, Big Muddy field. Technical progress report No. 48, October-December 1982.** Painter, T.R. (Conoco, Inc., Casper, WY (USA)). 1982. Contract AC03-78SF01424. 17p. NTIS, PC A02/MF A01. Order Number DE83011439.

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Polymer injection continued through the first quarter of 1983, bringing the total polymer-pusher slug size to 361,000 barrels. The average injection rate for the quarter was 1648 BPD, and the rate for March averaged 1706 BPD. This higher rate, compared to the 1982 fourth quarter average of 1515 BPD, was due to increased injection into R.B. Whiteside No. 101. Injection into R.B. Whiteside No. 101 was increased by placing a Triplex pump at the well in mid-February. The rate jumped from 28 BPD in January to 173 BPD in March; however, the bottom-hole injection pressure also increased from 1323 psi to 1620 psi. Pressure-parting (step-rate)

tests were unsuccessful in defining the fracturing pressure. Further analysis will include tracer surveys, fall-off tests and observation-well pressure measurements in order to monitor the effects of the increased injection. Oil production continued to increase during the quarter with sales averaging 175 BOPD, 167 BOPD and 172 BOPD for January, February and March, respectively. January was high due to 400 barrels of bad oil produced in December; actual production for January was 162 BOPD. Cumulative project production is 93,685 barrels of oil as of March 31, 1983. Minor sulfonate production (200 to 500 ppM) was observed in Wells Nos. 83, 87, 88 and 95; however, no serious treating problems have occurred yet. The sulfonated oil auxiliary treating facility is very close to completion and will be ready for startup by late May. 6 figures, 4 tables.

38447 **(DOE/SF/10761—3) Field demonstration of the conventional steam-drive process with ancillary materials. Final report.** Bowman, R. (CLD Group, Inc., Ventura, CA (USA)). Jun 1983. Contract FC03-79SF10761. 142p. NTIS, PC A07/MF A01. Order Number DE83013820.

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The purpose of this research was to evaluate the potential of chemicals for increasing the sweep of steam drive and displacement of oil. The project was conducted in four phases: preparation and laboratory work; field tests; verification field test; and data collection and analyses. The first year of the contract was spent screening surfactants for their ability to produce stabilized foams at elevated temperatures, conducting injection tests in the laboratory, and preparing for the field tests. The next two years were spent on five field tests in California. The field test locations were chosen to address two major technical problems encountered in steam drive operations; namely the excessive channeling of steam through thief zones, and the progressive increase in steam flow through oil-depleted, already swept zones. This final report completes the analysis of the two initial field tests and discusses the remaining three tests. The report consists of two parts. The first part summarizes the result of laboratory tests and presents the five field tests and their results. The second part analyzes the combined performance of the two tests at the Midway-Sunset Field.

38448 **(NMERDI—2-69-3302) Steamflood pilot in the O'Connell Ranch Field. Final report.** Martin, F.D. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Jun 1983. 75p. New Mexico Energy Research and Development Inst., 117 Richmond Dr. N.E., Albuquerque, NM 87106.

This project was a cooperative effort with Corona Oil Company of Dallas, TX. The purpose of the project was to investigate the technical feasibility of a small steamflood project to recover heavy oil from the O'Connell Ranch Field, Guadalupe Co., NM. The heavy oil of the Santa Rosa sandstone should not be confused with the Santa Rosa Tar Sands. The Santa Rosa reservoir is thin and shallow; permeability and porosity are low in comparison to reservoirs where successful steamfloods have taken place. Because of the shallow depth of this part of the reservoir, low injection pressures must be maintained to avoid fracturing the formation. This requirement, together with the low permeability, has resulted in relatively low steam injection rates. Since the steam rates are low and the pay interval is fairly thin, much of the injected heat undoubtably has been lost to adjacent rock. To date, no significant oil response has occurred; after 16 months of steam injection, only 70 barrels of oil have been produced. At the present rate of injection, calculations suggest that modest response may occur within a few months. Methods of stimulating the injection well for improved injectivity are necessary for the project to be economically attractive. Additional drilling has located deeper and thicker parts of the reservoir, and these areas should be investigated. 4 figures, 20 tables.

38449 **In situ combustion method for heavy oil recovery: technical problems and potential for their solution.** Stosur, J.J.G. (Dept. of Energy, Washington, DC). pp 3-12 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—).

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

The philosophy of in situ combustion technology is the use of energy derived from burning a small fraction of oil in a reservoir to assist in the recovery of the remaining unburned oil. The method is potentially one of the most widely applicable enhanced oil recovery (EOR) techniques and utilizes the cheapest and most readily available fluids: air and water. Yet the process is beset with difficult-to-solve and expensive-to-correct operational problems. While the performance of most other EOR processes now can be simulated sufficiently, simulation of the in situ recovery process is the least advanced and appears to remain a task beyond man and computer. Other problems inhibiting its wider application range from early breakthrough of firefront, which may destroy production wells, to inability to control the process adequately, severe corrosion and hard emulsion in producing wells. It is shown that the method offers the potential for the highest percentage of oil recovery. Comparison of the recovery efficiency with other EOR processes will be presented.

38450 **Optimization of flooding process by caustic flooding for enhanced oil recovery.** Jang, L.K.; Chan, M.; Yen, T.F. (Univ. of Southern California, Los Angeles). pp 23-28 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—). Contract AS19-78ET12382.

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

Optimum flooding conditions for different crude oils could be determined individually by relatively simple procedures. Sand-packed core flooding runs were used to demonstrate the effectiveness of carrying out caustic flooding using these conditions as guidelines.

38451 **Tertiary oil recovery by aqueous chemical solutions.** Kamath, K.I.; Taylor, B.D.; Vining, E.A. (Morgantown Energy Tech. Center, WV). pp 29-59 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—).

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

Chemical flooding, typified by the micellar-polymer process, is inherently limited to the recovery of very light oils and requires large chemical outlays per unit of produced oil. Above all, it calls for exacting flood design. In contrast, ongoing work on tertiary oil recovery at this Center indicates that a minor fraction of a water-soluble synthetic sulfonate detergent is an excellent oil-recovery agent. The remarkable ability of the detergent concentrate for oil recovery is augmented very substantially via a mobility-independent mechanism by the presence of very small amounts of additives such as polyacrylamide, urea, polyvalent phosphate anions, etc. Oil recoveries depend on the amount (not concentration) of the sulfonates and are independent of oil viscosity up to 110 cps. The results hold good prospects for developing a simple, economical tertiary process for recovering much of our estimated 250 billion barrel resource of light oils. They also offer possibilities of correlation of enhanced oil recovery (EOR) activity with chemical structure.

## 0204 Processing

38452 **Preprints symposia.** Haines, W.E. (ed.). Washington, DC; American Chemical Society (Mar 1983). 327p. (CONF-830303—). Treasurer, 321 Browning Bldg., Univ. of Utah, Salt Lake City, UT 84112.

From 185. American Chemical Society national meeting; Seattle, WA, USA (20 Mar 1983).

Am. Chem. Soc., Div. Pet. Chem., Prepr.; 28: No. 3 (Mar 1983).

Papers presented at the various symposia were abstracted and indexed separately.

## 0206 Health And Safety

*REFER ALSO TO CITATION(S) 38430*

## 0207 Marketing And Economics

*REFER ALSO TO CITATION(S) 38426, 38999*

**38453 (DOE/EIA—0109-(83/06)) Petroleum supply monthly.** (USDOE Energy Information Administration, Washington, DC). Jun 1983. 89p. NTIS, PC A05/MF A01. Order Number DE83013942.

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Current data are presented on the supply and distribution of petroleum and petroleum products in the US for April 1983. Data include: national statistics; supply and disposition of crude oil and petroleum products by PAD districts; production of crude oil and lease condensate; natural gas processing; refinery operations by PAD district; imports and exports of crude oil and petroleum products; stocks; transportation of crude oil and petroleum products between PAD districts; and heavy fuel oils by sulfur content. (ATT)

**38454 (DOE/EIA—0292(82)) Assessment of the quality of principal data series of the Energy Information Administration.** (USDOE Energy Information Administration, Washington, DC. Office of Statistical Standards). Apr 1983. 291p. NTIS, PC A13/MF A01. Order Number DE83013839.

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This report presents information on the accuracy of a portion of the Energy Information Administration's petroleum product and natural gas data series. A previous report, An Assessment of the Accuracy of Principal Data of the Energy Information Administration, published in June 1981 assessed the accuracy of EIA's annual estimates for the supply and disposition of crude oil, petroleum products, natural gas, and coal for each of the years 1977 through 1979. The present report includes both 1980 annual data and monthly data for 1977 through June 1981. More recent data were being revised while this report was being prepared and were, therefore, not included. Prices of petroleum products are included for the first time, but coal, electricity and nuclear data are not examined. The estimates refer to quantities in commerce within the United States. This report is organized into five chapters. Chapter 1 summarizes the scope of the report and describes in some detail the methods used to estimate accuracy. Chapter 2 presents an overview of the petroleum products industry and EIA's approach to measuring petroleum flows. This overview is followed by an appraisal of the major data collection instruments and by comparisons of EIA reference estimates to other volume estimates of motor gasoline, distillate and residual fuel oil, kerosene and liquefied gases. Chapter 3 is similarly organized and contains comparative analyses of the prices of motor gasoline, distillate and residual fuel oil. Chapter 4 introduces a simple accounting structure for the natural gas industry and presents comparative estimates. The final chapter discusses methods of detecting changes in the historical relationship between two series.

**38455 (DOE/EIA—0340(82)/1-Vol.1) Petroleum supply annual 1982. Volume I.** (USDOE Energy Information Administration, Washington, DC). Jun 1983. 154p. NTIS, PC A08/MF A01. Order Number DE83013570.

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The Petroleum Supply Annual (PSA) contains information on the supply and disposition of crude oil and petroleum products. The publication reflects data that were collected from the petroleum industry during 1982 through annual and monthly surveys. The PSA is divided into two volumes. This first volume contains the following four sections, each with final annual data: (1) petroleum supply summary; (2) refinery capacity; (3) sales of liquefied petroleum gases; (4) deliveries of fuel oil and kerosene.

**38456 (DOE/PE/70124—T1) Effect of governmental regulations on subsidization in the sale of gasoline.** Ryan, T.C. (Ryan (Thomas C.), Houston, TX (USA)). 15 Mar 1980. Contract AC01-79PE70124. 37p. NTIS, PC A03/MF A01. Order Number DE83013636.

Federal and state governments have, since at least 1781, sought to influence the course of economic events in the US. In the twentieth century, this influence has largely been felt through the use of federal and state regulation and taxation policies. The purpose of this report is to discuss those tax laws and regulations that have had the most substantial effect on the issue of gasoline/marketing subsidization. Most of those that have had the greatest effect on the profitability of petroleum exploration and production (demand proration, mandatory import restrictions, the depletion allowance, the foreign tax credit) have been largely diluted by current economic events or changes in regulations and tax laws. A new series of regulations continually promulgated between 1973 and the present, however, has substantially affected the issue of subsidization of gasoline. Because of the number and complexity of the regulations, a case method was used to describe some of the effects of these laws on gasoline retailing and the issue of subsidization. Because one of the functions of the regulations is to maintain the market shares of various classes of trade, economic efficiency has tended to suffer at the hands of regulation. As a consequence, it is very likely that the returns available to some refiner/marketers and retailers have been artificially lowered by federal regulations and guidelines while others have been artificially raised.

**38457 (DOE/PE/70124—T2) History of the issues surrounding subsidization in the sale of gasoline.** Ryan, T.C. (Ryan (Thomas C.), Houston, TX (USA)). [nd]. Contract AC01-79PE70124. 74p. NTIS, PC A04/MF A01. Order Number DE83013635.

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The purpose of this report is to set in an historical context the current charges of subsidization of gasoline marketing. These allegations center about the use, or potential use, of funds generated in other geographic or functional areas to support minimal income or operating losses at the wholesale or retail level. The subsidization of these operations, although beneficial to the consumer in the short-term, will have far-ranging detrimental effects through a reduction of competition in the marketing of gasoline. The report is a discussion of the issues surrounding subsidization and the expressed concerns of the industry participants involved with these issues.

## 0208 Waste Management

*REFER ALSO TO CITATION(S) 38466, 39000*

**38458 (PB—83-175877) Physical beneficiation of titanium plant solid wastes: recovery of titanium minerals and coke. Report of investigations 1982.** Paige, J.I.; Mussler, R.E.; Elger, G.W. (Bureau of Mines, Albany, OR (USA). Albany Research Center). Jan 1983. 29p. NTIS, PC A03/MF A01.

The Bureau of Mines studied methods for recovering unreacted titanium minerals and petroleum coke from titanium chlorination plant wastes prior to neutralization treatment with lime. The objective was to recover valuable raw materials and to reduce the amount of waste materials that must be treated for disposal. Samples of solid wastes were physically beneficiated by gravity concentration (tabling) to recover titanium minerals containing 69.0 to 92.4 wt-pct TiO2 and by selective carbon flotation to recover petroleum coke containing 94.0 to 96.8 wt-pct C. Laboratory data indicate that the recovered titanium mineral would decrease the amount of solid waste to be disposed of from 32.8 to 53.9 wt-pct. The recovery of coke would further decrease the amount by additional 32.9 wt-pct.

**38459 Utilization of by-products from used-oil re-refining.** Brinkman, D.W. (Bartlesville Energy Technology Center, OK); Weinstein, K.D.; Craft, S.R. *Energy Progress;* 3: No. 1, 44-49(Mar 1983). Contract AC19-79BC10059.

This paper presents the results of research into practical uses for many of the by-products of various re-refining processes. By turning problematic by-products into saleable products, the used-oil recycling industry could begin a resurgence and the valuable resource represented by lube oil base-stocks could be conserved. The study included sampling of the by-product streams from five re-refineries representing three processes; subsequent chemical and phys-

ical characterization of the samples; development of possible by-product steam utilization options; feasibility testing of the promising options; and general economic analyses of the technically feasible options. The by-product streams sampled and analyzed were grouped into two categories based upon primary characteristics: (1) hydrocarbon/sludge/clay samples and (2) water samples. During engineering-tests phase of the study, technically viable utilization options were found for each by-product stream with the possible exception of process waters. Various options included fuel oil, carbon black feedstock, internal combustion fuel, asphalt component, soil stabilization, lube recovery, grease component, and AFB fuel. There are genuine opportunities for improved economics within re-refining by turning many of the by-products generated now as wastes into useful products. 4 tables. (DP)

## 0209 Environmental Aspects

38460 **(PB—83-171595) Overview of oil field brine problems in three Illinois counties. Final report.** (Greater Egypt Regional Planning and Development Commission, Carbondale, IL (USA)). Nov 1982. 148p. NTIS, PC A07/MF A01.

This report concludes Phase II of a two-part project designed to inventory oil field brine damage and examine its potential effect on water quality. In addition, reclamation procedures used in Hamilton County, public education and legislative aspects of the brine damage problem were to be examined. The report gives the results of a brine damage survey in Franklin and Jefferson Counties in Southern Illinois with data tables, maps and data analysis. The report also provides a Regulatory Procedures Guide which explains enactments, rules and regulations covering Illinois oil production; gives information for processing of salt damage complaints and provides information regarding surface landowners rights in oil production areas.

## 0210 Legislation And Regulation

*REFER ALSO TO CITATION(S) 38456, 38999, 39001*

## 0220 Transport, Pipelines, And Handling

*REFER ALSO TO CITATION(S) 38999*

## 0230 Properties

*REFER ALSO TO CITATION(S) 38442, 38445, 38592, 39340*

38461 **(PB—83-172940) Certification of four gas oils for sulphur content. (BCR reference materials numbers 104, 105, 106 and 107). Final report.** Lindsey, A.S.; Colinet, E.; Wagstaffe, P.J.; Haemers, L. (Commission of the European Communities, Luxembourg). [nd]. 57p. NTIS, PC AE04/MF E04.

The sulphur content of four gas oils has been determined by five independent methods in an interlaboratory exercise in which fourteen laboratories in Member Countries of the European Community have participated. The analytical methods utilized for the certification measurements were the Wickbold combustion method, X-ray fluorescence analysis, bomb combustion method, Schoniger flask combustion method, and inductively coupled plasma (ICP) emission spectroscopy. The report includes the initial stability study and the experimental details of the certification measurements.

## 0240 Storage

38462 **(SAND—83-0630) Chemistry and mineralogy of samples from the Bayou Choctaw, Bryan Mound, Sulfur Mines, Weeks Island and West Hackberry strategic petroleum reserve sites, November 1979 through August 1982.** Bild, R.W. (Sandia National Labs., Albuquerque, NM (USA)). May 1983. Contract AC04-76DP00789. 39p. NTIS, PC A03/MF A01. Order Number DE83013530.

Chemical and mineralogical data collected on salt core, brine and related samples from five Strategic Petroleum Reserve (SPR) sites over the last three years are collected here for the purpose of documentation and easy reference. The data include identification of the minerals present in bulk core samples and in the water insoluble fractions of core, chemical analysis and densities of core and brine samples, and chemical analysis and mineral identification of materials produced during cavern leaching and during tests conducted on salt dome samples. Core samples are typically greater than 90% halite with the remainder anhydrite. Water insoluble minerals present during various stages of the leaching process are anhydrite and very small amounts of dolomite, calcite, barite and silicate minerals; and a water insoluble mineral inside Bryan Mound brine lines is vaterite. Brine samples analyzed are typically at or near NaCl saturation and contain variable amounts of $Ca^{++}$ (0.15 to 2.8 mg/g) and $SO_4^{2-}$/ (0.41 to 4.1 mg/g). 25 tables.

# 03 NATURAL GAS

38463 **(DOE/METC—83-65) Interdisciplinary gas hydrate literature bibliography.** Malone, R.D. (ed.). (USDOE Morgantown Energy Technology Center, WV). Jun 1983. 61p. NTIS, PC A04/MF A01. Order Number DE83013785.

This bibliography is comprised of 650 bibliographic citations of publications which are not available from the Morgantown Energy Technology (METC) Library. These citations are a list of current journal articles, books, reports, proceedings, conference or symposium papers, and foreign language works. They are publications which date back to 1823. For the researcher or interested individual, these bibliographies are a resource. They provide general and specific hydrate characterization information as well as the history and current state-of-the-art exploration and production of gas activities.

## 0301 Reserves

*REFER ALSO TO CITATION(S) 38394, 38435, 38467*

## 0302 Geology And Exploration

*REFER ALSO TO CITATION(S) 38436, 38437, 38440, 38482, 39457*

38464 **(SAND—83-1078) Reservoir sedimentology in Mesaverde rocks at the Multi-Well Experiment site.** Lorenz, J.C. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1983. Contract AC04-76DP00789. 39p. NTIS, PC A03/MF A01. Order Number DE83013959.

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Three types of sandstone reservoirs are encountered in Mesaverde rocks in the US Department of Energy's Multi-Well Experiment (MWX) in the east-central Piceance Creek Basin of northwestern Colorado. Characteristics of each type of tight-gas-sand reservoir are a function of the environment in which the sandstones were deposited. Sandstone reservoirs deposited in a fluvial environment are composed of stacked point-bar deposits, creating irregular, composite sand bodies. Underlying this, distributary channel reservoirs were deposited on a delta plain as elongate lenticular bodies. They are associated with mudstones on the upper delta plain (coastal) and mudstones and coals on the lower delta plain (paludal). Below these environments is a series of blanket sandstone reservoirs deposited as regressive, wave-dominated deltas and shorelines, with inter-bedded nonmarine coals and marine shales. Best estimates of reservoir morphology, dimensions, trends, and internal characteristics can be made on the basis of sedimentological models and characteristics observed in outcrops and in core. 8 figures.

## 0303 Drilling, Production, And Processing

38465 **Cool-down flow-rate limits imposed by thermal stresses in LNG pipelines.** Novak, J.K.; Bartlit, J.R.; Edeskuty, F.J. (Los Alamos National Lab., Univ. of Calif., Los Alamos, NM). pp 963-970 of Advances in Cyrogemic Engineering, Vol. 27. Fast, R.W. New York, NY; Plenum (1982). (CONF-810835—).

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Calculations are extended from previous studies of the low flow-rate limits based on avoidance of stratified two-phase flow for pipelines cooled with liquid hydrogen or nitrogen. Here pipelines made of AISI 304 stainless steel, 6061 aluminum, or ASTM A420 9% nickel steel are included. The latter being cooled by liquid methane or a typical liquefied natural gas. Low and high flow-rate limits are presented with the parameter combinations and coefficients of the equations tabulated, giving maximum cool-down flow rates for methane. The discussion outlines the findings for components of certain sizes, especially thick ones in small-diameter pipelines; there exists no steady cool-down flow rate that both avoids stratified flow and keeps the maximum thermal stress within desired limits. Such pipelines may be cooled with cold gas or by intermittent cool-down schemes where small quantities of liquid are introduced into the pipelines and allowed to evaporate.

## 0306 Marketing And Economics

*REFER ALSO TO CITATION(S) 38426, 38453, 38454, 38467*

## 0307 Waste Management

38466 **(PB—83-173377) Brine disposal options for geopressed methane development. Annual report.** Tatom, F.B.; Mullen, M.W. (Engineering Analysis, Inc., Huntsville, AL (USA)). Dec 1982. 232p. NTIS, PC A11/MF A01.

Brine disposal practices associated with conventional oil and gas field operations were examined along with brine disposal procedures relevant to the Strategic Petroleum Reserve (SPR) program. Four specific case studies were carried out involving brine disposal from North Markham-North Bay City oil field, Bryan Mound SPR facility, Louisiana Offshore Oil Port (LOOP), and Sweet Lake Prospect geopressured test well. A review of all available disposal options was completed resulting in the conclusion that the two most suitable options for geopressured brine disposal are subsurface injection and offshore submerged discharge. These two options were examined on engineering, environmental, and economic considerations.

## 0309 Artificial Stimulation

*REFER ALSO TO CITATION(S) 38394, 39477*

38467 **(ANL/EES-TM—223) Westerm tight-sands gas development: economic and regulatory aspects of blanket-resource supply. Final report, March 1981-May 1983.** Hanson, D.A.; South, D.W. (Argonne National Lab., IL (USA)). May 1983. Contract W-31-109-ENG-38. 116p. NTIS, PC A06/MF A01. Order Number DE83014387.

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The purpose of this study is to assess the recoverable quantities and extraction costs of western tight-sands gas from blanket formations. Tight-sands gas is one of the four designated unconventional gas resources. Blanket tight-sands gas is characterized by its deposition in continuous rock strata of low permeability and thereby results in a low production rate in the absence of artificial stimulation. In this report, the only stimulation method we consider is massive hydraulic fracturing (MHF). Furthermore, in this study, we specifically investigate how the quantities and extraction costs of blanket tight-sands gas depend on and are affected by: (1) rate of return and risk premium; (2) technology advancement; (3) well-spacing and land-use regulations; and (4) impediments to near-term development. The results of this assessment are shown as families of marginal-cost curves or resource-supply curves. These curves illustrate the sensitivity of the recoverable resource and extraction costs to the cases analyzed. 24 figures, 14 tables.

38468 **(NYSERDA—81-18) Shale gas in the southern central area of New York State. Volume III. Experience of drilling five shale-gas wells in New York State.** (Arlington Exploration Co., Boston, MA (USA)). Mar 1983. 102p. NTIS, PC A06/MF A01. Order Number DE83013034.

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Five shale-gas wells have been located and drilled in the South-Central areas of New York State as part of this program. The program was undertaken by Arlington Exploration Company (AEC) during 1981 and 1982. The wells were drilled on educational properties in an attempt to demonstrate the economic prospect of natural gas for institutional and small commercial consumers to develop their own source of energy. All five wells were completed in the Marcellus section of the Devonian shale. Each of the five wells was connected to an appropriate heat load for the purpose of production testing. The project supports the theory that a well drilled anywhere in South-Central New York and completed in the Marcellus Shale using modern fracturing techniques (i.e. nitrogen foam) is likely to produce some gas. Important factors not yet predictable are the decline rate of Marcellus production and the volume of recoverable reserves. Depths to the Marcellus Shale generally increase from north (i.e. Houghton College) to south (i.e. Portville Central School).

## 0310 Legislation And Regulation

*REFER ALSO TO CITATION(S) 38467*

## 0340 Combustion

38469 **(PB—83-188615) Mechanistic and kinetic studies of the elementary processes in catalytic combustion of methane. Annual report Sep 81-Aug 82.** Kung, H.H.; Butt, J.B. (Northwestern Univ., Evanston, IL (USA)). Oct 1982. 18p. NTIS, PC A02/MF A01.

This report describes the progress towards determining the kinetics and the mechanism in the catalytic oxidation of methane by studying the reaction of some postulated intermediates on a well-characterized surface. Current emphasis is on the intermediate methylene radical. Preparation of the precursor for methylene, diazomethane is briefly described. An initial result suggested that diazomethane on adsorption on platinum decomposed readily to gaseous nitrogen and an adsorbed carbonaceous species. On heating methane and ethylene are the major products in the absence of oxygen. In contrast, adsorbed ethylene does not undergo reaction before desorption. This evidence suggests that the decomposed product is the desired methylene radical.

# 04 OIL SHALES AND TAR SANDS

## 0401 Reserves And Exploration

38470 **(LA—9606) Ranking methodology for determining the relative favorability for commercial development of US tar-sand deposits.** Aamodt, P.L.; Freiwald, J.G. (Los Alamos National Lab., NM (USA)). Mar 1983. Contract W-7405-ENG-36. 24p. NTIS, PC A02/MF A01. Order Number DE83013328.

As a part of the DOE's program to stimulate petroleum production from unconventional sources, the Los Alamos National Laboratory has developed a methodology to compare and rank tar sand deposits, based on their suitability for commercial development. Major categories influencing favorability were identified and evaluated to determine their individual and collective impacts. To facilitate their evaluation, deposit characteristics, extraction technologies, environmental controls, and institutional constraints were broken down into their elements. The elements were assessed singly and in interactive groups to determine their influence on favorability for commercial development. A numerical value was assigned

each element to signify its estimated importance relative to the other elements. Eight tar sand deposits were evaluated using only one major category, deposit characteristics. This initial, and only partial favorability assessment, was solely a test of the methodology, and it was considered successful. Because only one of the four major categories was used for this initial favorability ranking, and also because the available deposit characteristic data were barely adequate for the test, these first results should be used only as an example of how the methodology is to be applied when more complete data are available. The eight deposits and their relative favorability rankings for commercial development, based only on the deposit characteristics, are Sunnyside, Utah; Asphalt Ridge, Utah; Edna, California; Santa Rosa, New Mexico; Tar Sand Triangle, Utah; PR Spring, Utah; Uvalde, Texas; and circle cliffs, Utah.

## 0402 Site Geology And Hydrology

*REFER ALSO TO CITATION(S) 38819*

## 0403 Drilling, Fracturing, And Mining

38471 **(PB—83-168567) Surface oil mining - a technical and environmental assessment. Open file report (final) 1 Nov 79-30 Sep 81.** Richings, M.; Lansing, L.; Readdy, L. (Golder Associates, Inc., Lakewood, CO (USA)). 20 Oct 1981. 267p. NTIS, PC A12/MF A01.

The report describes the work performed and the results obtained for the study to determine the environmental problems that would be encountered in the surface mining of the P.R. Spring tar sand deposit in Utah and the Kern River heavy oil sand deposit in California. This report includes a discussion of the criteria for selecting the two deposits for this study; the existing site conditions for each deposit, including geologic, hydrologic, and environmental conditions; development plans for the mining and processing of the tar sands and heavy oil sands along with an economic evaluation of the deposits; and the environmental impacts resulting from the development of the two deposits and the mitigating procedures recommended to minimize these impacts.

38472 **(PB—83-171801) Fire and explosion properties of oil shale. Report of investigations/1982.** Richmond, J.K.; Sapko, M.J.; Miller, L.F. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Dec 1982. 46p. NTIS, PC A03/MF A01.

This is a progress report sumMarizing more than 5 years of a long-range Bureau of Mines research program. The purpose of this program has been to investigate the fire and explosion properties of Green River oil shale in the Bureau's Experimental Mine, in laboratories, and in the field. The lean limits of explosibility of oil shale dust, by small- and large-scale tests, are reported as a function of grade, ignition source, and particle size. A limited number of laboratory tests on the autoignition of oil shale dust layers and the spontaneous combustion tendencies of oil shale are described. Moderate-scale rubble fire tests were conducted to determine flame spread rates as a function of ventilation flow.

## 0404 Oil Production, Recovery, And Refining

*REFER ALSO TO CITATION(S) 38373, 38373*

38473 **(DOE/LC/10787—115) Investigation of the Geokinetics horizontal in-situ oil-shale-retorting process. Quarterly report, January-March 1983.** Wege, L. (Geokinetics, Inc., Salt Lake City, UT (USA)). May 1983. Contract FC20-78LC10787. 107p. NTIS, PC A06/MF A01. Order Number DE83012970.

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An in situ process is being developed for recovering shale oil using a fire front moving in a horizontal direction. The project is being conducted at a field site, Kamp Kerogen, located 70 miles south of Vernal, Utah, on Section 2, Range 22 East, Township 14 South, Uintah County, Utah. The process is a true in situ method for extracting oil from oil shale. The oil shale is fractured by means of explosives placed in blastholes drilled from the surface. After a specific area has been fractured to create an in situ retort, air injection wells are drilled at one end and off gas recovery (air-out) wells are drilled at the other. The oil shale is ignited at the air injection wells and air is continually injected to establish and maintain a burning front. The front is moved in a horizontal direction through the fractured rock. This heats the shale, driving out the shale oil which drains to the bottom of the retort where it is recovered through oil production wells. As retorting progresses from the air-in to the air-out wells, the residual coke serves as the primary fuel source to sustain the moving burn front. The combustion gases are recovered at the off gas wells. Retort No. 26 produced 23,106 barrels of shale oil during its 246 day production phase. Construction is in progress on retorts 27 and 28.

38474 **Comparison of methods for the determination of total sulfur in oil shales.** Laffoon, A.M.; Wilderman, T.R. (Colorado School of Mines, Golden). pp 161-168 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—). Contract AS04-76ET44206.

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

Extensive analyses were performed for total sulfur and different sulfur species in raw and spent oil shales and in retort waters. In the solid samples, it was found that the majority of the sulfur exists in iron sulfide species in raw shale. When the shale is retorted in the absence of oxygen, the pyrite breaks down. When the shale is retorted with some oxygen introduced, the pyrite remains stable and the ankerite breaks down. In the retorted shales, almost all the sulfur is in iron sulfide phases. In the waters from surface retorts, a significant fraction of the sulfur exists as the thiosulfate ion. Thiocyanate is present and comprises 1% of the sulfur in these waters. For the retort waters, it is possible to take an Eh measurement that is somewhat reproducible. The value of the Eh corresponds to what one would expect for a $SO_3^{2-}/S_2O_3^{2-}$ oxidation and reduction couple. These observations on the waters suggest that this sulfur couple is establishing the oxidation capacity of the water and that a simple Eh measurement might be used to detect the presence of reduced sulfur species in waters from fossil fuel processes.

## 0405 Properties And Composition

*REFER ALSO TO CITATION(S) 38368, 38472*

38475 **(DOE/BC/10525—4) Mechanisms of syncrude/synfuel degradation. First annual report, September 15, 1981-September 30, 1982.** Hazlett, R.N.; Cooney, J.V.; Beal, E.J. (Naval Research Lab., Washington, DC (USA). Chemistry Div.). Jun 1983. Contract AI19-81BC10525. 100p. NTIS, PC A05/MF A01. Order Number DE83013819.

Fuel stability tests have been conducted at three temperatures - 43, 65 and 80°C - with a wide variety of added nitrogen compounds. Most pyrroles develop copious amounts of total insolubles (filtered solids + adherent gum) but pyridines, quinolines, tetrahydroquinolines, pyrazoles, pyrrolidines, piperidines and pyrazines form modest amounts of sediments. A time-temperature-concentration matrix for sediment formation has been developed for 2,5-dimethylpyrrole (DMP). A very regular pattern has been found with a first order dependence on DMP concentration and an apparent energy of 12 kcal/mole. Basic extracts from two shale derived fuels, when added to the US Navy Shale-II diesel fuel, developed modest amounts of total insolubles.

38476 **(LBL—15937) Organometallic geochemistry. Isolation and identification of organoarsenic and inorganic arsenic compounds from Green River Formation oil shale.** Fish, R.H. (Lawrence Berkeley Lab., CA (USA)). Jun 1983. Contract AC03-76SF00098. 15p. (CONF-830364—1). NTIS, PC A02/MF A01. Order Number DE83012956.

From American Chemical Society symposium on geochemistry and chemistry of oil shale; Seattle, WA, USA (25 Mar 1983).

The molecular characterization of methylarsonic acid, phenylarsonic acid and the inorganic anion, arsenate, found in a methanol extract of a Green River Formation oil-shale sample was accomplished by HPLC-GFAA analysis. In addition, derivatization of the acids, HPLC purified, by reaction with 3-methylcatechol to form the five coordinate organoarsenic catecholates as well as reaction, via trimethylsilylation, of the ammonium salt of arsenate to form tristrimethylsilylarsenate was followed by GC-EIMS analysis to provide unequivocal evidence for the presence of these organometallic and inorganic compounds of arsenic as natural products in oil shale.

38477 **Carboxylic acids from the treatment of Green River oil shale with carbon monoxide and water.** Chong, S.L. (Laramie Energy Tech. Center, WY). pp 143-159 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—).

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

The carboxylic acids produced from the reaction of Green River oil shale kerogen with carbon monoxide and water at temperatures of 300 to 40°C were investigated. The acids were esterified with diazomethane, and the acid esters were separated by chromatographic techniques into two fractions: -n-saturated and branched-plus-cyclic saturated acid ester fractions. Gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS) analyses of the n-saturated fractions showed the presence of carboxylic acids $C_{14}$ to $C_{34}$ chain length, and the even odd predominance (EOP) was high in fractions produced below 450°C. Isoprenoid saturated acid and terpenoid saturated acid compounds in the branched-plus-cyclic saturated acid fraction predominated at 300°C but decreased tremendously at 450°C. The results of this study show that structures containing carboxyl groups are major components of Green River oil shale kerogens.

38478 **Fire and explosion properties of oil shale.** Richmond, J.K.; Sapko, M.J.; Miller, L.F. Pittsburgh, PA; Bureau of Mines (1982). 43p.

This is a progress report summarizing more than 5 years of a long-range Bureau of Mines research program. The purpose of this program has been to investigate the fire and explosion properties of Green River oil shale in the Bureau's Experimental Mine, in laboratories, and in the field. The lean limits of explosibility of oil shale dust, by small- and large-scale tests, are reported as a function of grade, ignition source, and particle size. A limited number of laboratory tests on the autoignition of oil shale dust layers and the spontaneous combustion tendencies of oil shale are described. Moderate-scale rubble fire tests were conducted to determine flame spread rates as a function of ventilation flow. With the aid of a system to continuously monitor methane emissions in a deep oil shale mine, the characteristics of the methane flow are reported as a function of ventilation and blasting procedures, and are compared with gas yields from core samples. Tentative predictions as to the emission of the methane to be expected in deep oil shale mines, far from the outcrop, are offered. Brief reference is made to a parallel investigation into the fire and explosion hazards of oil shale mining and processing by a Bureau contractor; detailed results of the latter investigation are to be found in the contractor's reports. 43 figures.

## 0406 Direct Uses And By-products

*REFER ALSO TO CITATION(S) 38412*

## 0407 Health And Safety

*REFER ALSO TO CITATION(S) 38430, 38472*

## 0408 Marketing And Economics

*REFER ALSO TO CITATION(S) 38470*

## 0409 Waste Research And Management

*REFER ALSO TO CITATION(S) 38474*

38479 **Speciation of inorganic arsenic and organoarsenic compounds in fossil fuel precursors and products.** Brinckman, F.E. (National Bureau of Standards, Washington, DC); Weiss, C.S.; Fish, R.W. pp 197-214 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—). Contract AC03-76SF00098.

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

The nature of metals and metalloids in fossil deposits and current status of analytical methods for the determination of trace metals in fossil materials are surveyed. A method for the determination of arsenic compounds in shale oil, shale retort waters and oil shale kerogen is described in some detail. Arsenic compounds were separated from 7 in situ shale oil retort and process water samples using high pressure liquid chromatographic (HPLC) columns. Two Perkin-Elmer graphite furnace atomic absorption spectrometers, Models 4000 and 460, were used as arsenic-specific detectors in conjunction with the HPCL. It was demonstrated that each retort or process water has a distinctive fingerprint and that substantial, but variable quantities of arsenate, methylarsonic acid and phenylarsonic acid are present, while arsenite and dimethylarsinic acid probably are absent or marginally detected. (BLM)

## 0410 Enviromental Aspects

38480 **(PB—83-177964) Water requirements and pollutant potential in the gasification of carbonaceous shales. Water quality series report.** Cissell, J.A.; Adams, V.D.; Fletcher, J.E.; Filip, D.S.; George, D.B. (Utah State Univ., Logan (USA). Utah Water Research Lab.). Oct 1982. 68p. NTIS, PC A04/MF A01.

The Upper Colorado River Basin has vast deposits of lignaceous shales which now go largely unused but could potentially provide a valuable product through gasification. The technical feasibility of applying gasification processes currently used for coal, the water requirements of gasification in an arid climate, and potential pollution problems were examined through a series of laboratory studies. Quantities of phenols, ammonia-N, and total organic carbon produced were significantly less for the shales tested than for the coal. Differences in process condensate constituents, such as mutagenicity and trace elements, were also determined for the coal and shale samples. Results varied widely with the chemical characterization of the coal and shale.

38481 **Nitrogen fixation by legumes in retorted shale.** Hersman, L.E.; Molitoris, E.; Klein, D.A. (Colorado State Univ., Fort Collins). *Soil Biology and Biochemistry;* **13**: 429-430(1981).

A study was made to determine whether retorted shale additions would significantly affect symbiotic $N_2$ fixation. Results indicate that small additions of the shale may stimulate plant growth but with higher concentrations plants are stressed, resulting in a decreased biomass and a compensatory effect of an increased number of nodules and $N_2$ fixation potential. (JMT)

# 05 NUCLEAR FUELS

## 0501 Reserves

*REFER ALSO TO CITATION(S) 38483, 38486*

## 0502 Exploration

**38482 (USGS-BULL—1446) Eocene fluvial drainage patterns and their implications for uranium and hydrocarbon exploration in the Wind River Basin, Wyoming.** Seeland, D.A. (Geological Survey, Casper, WY (USA)). 1978. 24p. GPO.

Paleocurrent maps of the fluvial lower Eocene Wind River Formation in the Wind River Basin of central Wyoming define promising uranium- and hydrocarbon-exploration target areas. The Wind River Formation is thought to have the greatest potential for uranium mineralization in areas where it includes arkosic channel sandstones derived from the granitic core of the Granite Mountains, as in the channel-sandstone bodies deposited in Eocene time by a 40-kilometer segment of the eastward-flowing paleo-Wind River that exended westward from near the town of Powder River on the east edge of the basin. Channel-sandstone bodies with a Granite Mountains source occur south of this segment of the paleo-Wind River and north of the Granite Mountains. The southwestern part of this area includes the Gas Hills uranium district, but the channel-sandstone bodies between the Gas Hills district and the 40-kilometer segment of the paleo-Wind River may also be mineralized. This area includes the southeasternmost part of the Wind River Basin southeast of Powder River and contains northeasterly trending channel-sandstone bodies derived from the Granite Mountains. Limited paleocurrent information from the margins of the Wind River Basin suggests that the paleo-Wind River in Paleocene time flowed eastward and had approximately the same location as the eastward-flowing paleo-Wind River of Eocene time. The channel-sandstone bodies of the paleo-Wind Rivers are potential hydrocarbon reservoirs, particularly where they are underlain or overlain by the organic-rich shale and siltstone of the Waltman Shale Member of the Fort Union Formation. If leaks of sulfur-containing gas have created a reducing environment in the Eocene paleo-Wind River channel-sandstone bodies, then I speculate that the areas of overlap of the channel-sandstone bodies and natural-gas fields in the underlying rocks may be particularly favorable areas in which to search for uranium deposits.

**38483 (USGS-OFR—78-1093) Postulated model of uranium occurrence in the central mining area, Marysvale District, West-Central Utah.** Cunningham, C.G.; Steven, T.A. (Geological Survey, Denver, CO (USA)). 1978. 25p. Geological Survey, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

Uranium in the central mining area of Marysvale, Utah occurs in hydrothermal veins cutting granitic and volcanic rocks in the eastern source area of the Mount Belknap Volcanics. A preliminary model for the origin of the veins envisages deposition in near-surface fractures above an unexposed pluton that may host a porphyry-type ore deposit. This model is based on the work in progress by the US Geological Survey, and embodies all presently available data from field mapping, literature study, fluid inclusion studies, and diverse geochemical and isotopic studies. Recent advances in uranium geochemistry have been particularly helpful. The work is not yet complete so this model should be considered as a progress report suggesting possible targets for exploration and testing; such testing would in turn lead to refinements in the model and to a clearer understanding of vein-type uranium deposits in general. 2 figures.

**38484 (USGS-OFR—79-233) Uranium and thorium in granitic rocks of northeastern Washington and northern Idaho, with comments on uranium resource potential.** Nash, J.T. (Geological Survey, Denver, CO (USA)). 1979. 56p. Geological Survey, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

This study was undertaken to document the distribution of uranium or thorium in plutonic rocks as a possible general guide to uranium deposits within the plutons, adjacent to the plutons in contact zones, or in nearby sedimentary rocks. Northeastern Washington and northern Idaho is a uranium province in which many Cretaceous and Tertiary granitic plutons contain abnormal amounts of uranium. Mean uranium content of 108 samples of granitic rock is 8.8 parts per million (ppM), more than twice normal for rocks of this composition. The mean thorium content, 20.3 ppM, and mean Th/U, 3.19, are normal. The most uraniferous and fertile rocks are the peraluminous two-mica granitic suite, although not all two-mica plutons are enriched in uranium. The muscovite-bearing suite has mean uranium content of 22.3 ppM, mean thorium content of 22.8 ppM, and mean Th/U of 2.82. Porphyritic quartz monzonite of the Midnite mine, which I interpret to be a two-mica granitic rock, is especially radioactive with mean U of 14.7 ppM, mean Th of 32.1 ppM, and mean Th/U of 2.72. Mean uranium and thorium contents of the two-mice granitic plutons are significantly different from those of the calcalkaline hornblende granitic suite, which are mean U, 5.0 ppM; mean Th, 17.6; and mean Th/U, 3.78. Biotite granitic rocks containg no hornblende or muscovite appear to be an intermediate suite in terms of U and Th, or possibly are variants of both hornblende and muscovite type; mean U is 3.88 ppM, mean Th is 14.4 ppM, and mean Th/U is 3.03. The study area is favorable for at least 5 types of uranium deposits. Contact zone deposits and intragranitic hydrothermal veins, both possibly supergene-enriched, and basal-type deposits in Tertiary sandstone and conglomerate, seem most likely to be of economic importance. Exploration and discovery of potential uranium deposits in the area is severely hampered by deep weathering, glacial cover, and poorly exposed structure. 5 figures, 4 tables.

**38485 (USGS-OFR—79-430) Geochemical and generalized geologic maps showing the distribution and abundance of thorium, and distribution of uranium in selected samples, in the central Alaska Range, Talkeetna Quadrangle, Alaska.** Curtin, G.C.; O'Leary, R.M.; Tripp, R.B.; Cooley, E.F. (Geological Survey, Denver, CO (USA)). 1979. 25p. USGS, Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

**38486 (USGS-OFR—79-434) Environments favorable for the occurrence of uranium within the Mount Belknap caldera, Beaver Valley and Sevier River Valley, west-central, Utah.** Cunningham, C.G.; Steven, T.A. (Geological Survey, Denver, CO (USA)). 1979. 17p. Geological Survey, Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

In studying the economic mineral potential of the Tushar Mountains and adjacent areas in west-central Utah, members of the US Geological Survey have delineated several geologic environments that seem favorable for the occurrence of uranium deposits. This report is concerned primarily with three areas: (1) the ring fracture zone of the Mount Belknap caldera, (2) the Beaver Valley, and (3) the Sevier River Valley near Marysvale. The data and interpretations presented are tentative and will be revised as work in the area continues. Other environments containing uranium exist, but are not discussed here. This report presents preliminary geologic data and interpretations to assist in uranium resource evaluation by the US Department of Energy, and to aid in exploration programs by private industry.

**38487 (USGS-OFR—79-585) Analysis of borehole geophysical information across a uranium deposit in the Jackson Group, Karnes County, Texas.** Daniels, J.J.; Scott, J.H.; Smith, B.D. (Geological Survey, Denver, CO (USA)). 1979. 32p. Geological Survey, Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Borehole geophysical studies across a uranium deposit in the Jackson Group, South Texas, show the three geochemical environments often associated with uranium roll-type deposits: an altered (oxidized) zone, an ore zone, and an unaltered (reduced) zone. Five holes were drilled on this property to obtain borehole geophysical data and cores. The cores were analyzed for mineralogic and electrical properties. The borehole geophysical information at this property included induced polarization, resistivity, gamma-gamma density, neutron-neutron, gamma-ray, caliper, and single-point-resistance logs. Between-hole resistivity and induced polarization measurements were made between hole pairs across the ore deposit and off the ore deposit.

38488 **(USGS-OFR—79-675) Uranium results for 147 water samples from the Elkhorn Wilderness Study Area, Montana.** McHugh, J.B.; Miller, W.R. (Geological Survey, Denver, CO (USA)). 1979. 12p. USGS-Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

One hundred forty seven water samples were collected from the Elkhorn Wilderness during the summer of 1977 as a part of a mineral resource assessment study. Each sample was analyzed for uranium. Specific conductance and pH were also measured. Sample analyses and site locations are presented in this report.

## 0503 Mining

*REFER ALSO TO CITATION(S) 39427*

## 0504 Feed Processing

38489 **(DOE/ER/10738—1) Ion-exchange fibers for uranium recovery. Final report, September 8, 1980-November 6, 1981.** Babcock, W.C. (Bend Research, Inc., OR (USA)). 18 Dec 1981. Contract AC06-80ER10738. 26p. NTIS, PC A03/MF A01. Order Number DE83013634.

Development was initiated of ion-exchange fibers that could be used to extract uranium ions from solutions containing 10 ppM uranium or less, such as acid mine waters, leach solutions, various natural groundwaters, and perhaps even seawater. These fibers would ultimately be used to make large, loosely woven mats that could be placed in dilute solutions or uranium. Periodically, the mats would be removed and stripped of uranium with an appropriate solution. Two major approaches to making these fibers were investigated. One involved incorporating conventional amine solvent-extraction reagents into the pores of microporous, polysulfone fibers. This approach was unsuccessful due to a rapid loss of the reagents from the fibers. The second approach was to incorporate water-swollen gels of polymeric amines into the pores of the fibers. These fibers effectively extracted uranium from solutions containing 10 ppM uranium. An economic analysis based on the projected costs of mats made from these fibers and on the value of the uranium recovered by the fibers shows that the mats could be used to economically recover uranium from dilute solutions and that they offer a substantial cost advantage over conventional ion exchange.

38490 **(LA—9611) Thorium-plutonium chemical separation process.** Clifton, D.G.; Blum, T.W. (Los Alamos National Lab., NM (USA)). Mar 1983. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01. Order Number DE83013327.

A new chloride anion exchange process is described, which separates thorium from plutonium yet eliminates corrosive HCl fumes and consequent gas scrubbing equipment. Process flow sheet and experimental testing results are presented. Plutonium product yields of over 90% with <0.025 wt % thorium were obtained with single-pass processing of plutonium feed solutions contaminated by up to 46 wt % thorium.

## 0505 Enrichment

*REFER ALSO TO CITATION(S) 38572, 39305, 39521*

38491 **(K/CSD/INF—83/3) Numerical studies of the isotope distribution in a gas centrifuge using a tapered, double-parabolic axial flow.** Park, J.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1983. Contract W-7405-ENG-26. 26p. (CONF-830642—2). NTIS, PC A03/MF A01. Order Number DE83013011.

From 5. international workshop on gases in strong rotation; Charlottesville, VA, USA (6 Jun 1983).

Using a numerical technique developed previously (K/CSD/TM-36), a series of academic problems relating to the isotope distribution in a gas centrifuge has been solved. The centrifuge configuration used was the Rome machine specified in the proceedings of the Third Workshop and updated in the proceedings of the Fourth Workshop. In each case, the axial mass flux was specified to be of double-parabolic form, with downflow in the region nearest the outer wall and upflow adjacent to the downflow. The magnitude of the upflow was varied axially such that a tapered crossflow was produced. Parameters for the axial taper were selected based on theoretical considerations published by Von Halle (K/OA-4445). For the resulting velocity profile, the feed was selected to maximize the separative work. The numerical error due to the finite difference mesh was investigated. Two radial and five axial meshes were used. The separative works calculated using these meshes are presented, allowing an assessment of the error in the numerical technique. The effect of temperature variation on isotopic distribution was studied. Again, using a fixed double-parabolic axial profile, the temperature was varied in a systematic fashion, inducing local changes in the pressure diffusion and the mass diffusion coefficient. These changes led to variations in the predicted values for separative work. The predicted separative works are presented.

38492 **(K-Trans—235) Revolving drum for a gas centrifuge.** Fukai, T. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 28 Mar 1981. Contract W-7405-ENG-26. Translation of Japanese Patent S56-13,497. 7p. NTIS, PC A02/MF A01. Order Number DE83013659.

The present invention relates to the improvement in gas centrifuges, especially centrifuges for isotopes such as $UF_6$. The improvement is attained by connecting two revolving drums with a flexible joint which decreases the primary natural vibration of drum bending.

38493 **(K-Trans—247) End plate of gas centrifugal separator drum.** Fukai, T. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 28 Mar 1981. Contract W-7405-ENG-26. Translation of Japanese Patent 49(1974)-69861. 8p. NTIS, PC A02/MF A01. Order Number DE83013657.

The present invention concerns an improved end plate for a gas centrifugal separator drum, in particular, one designed for $UF_6$. The end plate comprises ring-shaped reinforcement parts made using a filament-winding method with carbon fiber and heat-setting resin and assembled in such a way that the center axis of the ring matches the rotation axis of the drum.

38494 **(K-Trans—234) End plates made of a composite material for the revolving drum of a centrifuge.** Yamanaka, T.; Onishi, H.; Fujiwara, M. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 18 Dec 1980. Contract W-7405-ENG-26. Translation of Japanese Patent S55-50461. 14p. NTIS, PC A02/MF A01. Order Number DE83013660.

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The present invention relates to improvement of the end plates of centrifuges, especially those for centrifugal gas separators. End plates made of a composite material for the revolving drum of a centrifuge consists of a carbon-fiber-reinforced plastic layer. This layer consists of carbon fibers either wound helically at an angle greater than 75° and less than 90° to the center line of revolution, or wound in a hoop, and a matrix of a thermosetting resin in which the carbon fibers are buried, which [matrix] is laminated with metal layers.

38495 **(K-Trans—232) Cylindrical concave body of composite fibrous material.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 9 Mar 1979. Contract W-7405-ENG-26. Translation of German Patent P-2909393. 7p. NTIS, PC A02/MF A01. Order Number DE83013662.

The invention is concerned with a cylindrical concave body of compound fibrous material which is intended to be exposed to high rotation speeds around its own longitudinal axis. The concave body in question has at least one layer of fibrils that are interwoven and enclose an identical angle with the longitudinal axis of the concave body in both directions. The concave body in question also has at least a second layer of fibrils that run in the direction of the circumference and are fitted radially to the outside. The cylindrical concave body of the invention is particularly well suited for application as a rotor tube in a gas ultra-centrifuge.

**38496 (K-Trans—179) Improvement of installations with isotopic enrichment by selective gas diffusion and equipped with motor compressors.** Germain, R.L.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 29 Jul 1976. Contract W-7405-ENG-26. Translation of French Patent Application No. 76 23644. 11p. NTIS, PC A02/MF A01. Order Number DE83013663.

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The invention deals with selective gas diffusion isotopic enrichment installations for nuclear fuels and concerns more specifically a structural body of the circuit. The enrichment unit involved in the inventions is of the integrated structure type and includes: a separation chamber with porous barriers between two volumes with different enrichment rates, a heat exchanger on the low-pressure flux, a part supporting the above-mentioned elements and the motor compressor and ensuring distribution of the fluxes of the working gas, and a motor compressor of the type that is integrated with the structures. The entire unit is in the form of a vertical cylindrical column that rests on a slab and is connected by pipes to the neighboring cells. The purpose of the invention is to arrange, with the framework of a compact enrichment unit, the internal walls of the supporting part so as to provide good aerodynamic qualities, permit the free expansion of elements of different temperature, and facilitate preparation, anti-corrosion coating, and surface state control operations.

**38497 (K-Trans—233) Method of isolation of gas by centrifugal isolation device.** Kojima, S. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 22 Sep 1973. Contract W-7405-ENG-26. C; Japanese Patent Application 682,533. 10p. NTIS, PC A02/MF A01. Order Number DE83013661.

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A method of isolation of blended gas of two or more different specific gravities by a centrifugal isolation device is claimed. The method is characterized by the use of fiber-reinforced resin in the material constituting the rotating drum of the centrifugal isolation device, maintenance of the temperature of gas within the rotating drum at a temperature at which the gas neither liquifies nor solidifies, in a temperature range which does not exceed 15°C from the temperature of liquefaction or solidification of gas, and by supply and exhaust of gas by the countercurrent method.

**38498 (K-Trans—240) Compound drum for a centrifugal separator.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 14 Mar 1972. Contract W-7405-ENG-26. Translation of Japanese Patent 71-12495. 25p. NTIS, PC A02/MF A01. Order Number DE83013658.

Portions are illegible in microfiche products.

This invention concerns a method for centrifugal separation of $UF_6$. The invention provides a composite drum capable of rapid rotation for use in a centrifugal separating arrangement for gaseous materials. The drum is provided with a first drum section comprised of a metal and a second drum section comprised of a fiber-reinforced synthetic material. The second drum section is applied on the outside peripheral surface of the first drum section, where the second drum section is provided with a number of annular components, each of which is shorter than the first drum section.

## 0507 Fuels Production And Properties

*REFER ALSO TO CITATION(S) 38571, 38576, 39103*

**38499 (LA-UR—83-1515) Surface structural determination of $UO_2$(111) using MeV ions.** Thompson, K.A.; Ellis, W.P.; Taylor, T.N.; Valone, S.M.; Maggiore, C.J. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 16p. (CONF-830570—1). NTIS, PC A02/MF A01. Order Number DE83012777.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

The $UO_2$(111) surface was studied using MeV ions incident along the <111> and <110> directions. In addition, this surface was well characterized by LEED and Auger analysis. A resonance at 3.05 MeV for $^4He$ elastic scattering from $^{16}O$ made it possible to study the surface peaks for uranium and oxygen simultaneously. By combining previous surface studies with detailed analysis of the surface peaks and rocking curves for this compound material, an outward relaxation of 0.19 A +- 0.01 A was determined for uranium.

**38500 A note on the assay of special nuclear materials in solution by x-ray fluorescence.** Canada, T.R.; Hsue, S.T. (Los Alamos National Laboratory, Los Alamos, New Mexico). *Nuclear Materials Management;* XI: No. 2, 91-92(Sum 1982).

Presents a formulation that allows empirical results of the "internal standard" approach to be understood in a quantifiable manner, and suggests an alternative measurement procedure that removes many of the technique's undesirable features while maintaining those that add to instrumental accuracy. Assumes that the reader is familiar with x-ray fluorescence (XRF) technology. Promises a more detailed presentation, including proof-of-principle experimental results, in the future. Points out that practical applications of this approach may be achieved with both K- and L-x-ray fluorescence. Concludes that the formulation and alternative measurement procedure suggested indicates that the "internal standard" approach may be improved by making measurements at one or more additional x-ray energies of the element to be assayed. Effects of solution acidity variations and the relative concentrations of plutonium and uranium may be avoided. Because of the inherent stability of ratio techniques, little or no modification to this formulation is anticipated for cylindrical near-field geometries.

## 0508 Spent Fuels Reprocessing

*REFER ALSO TO CITATION(S) 38571, 39234*

**38501 (DP—1647) Clarification of dissolved irradiated light-water-reactor fuel.** Rodrigues, G.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Feb 1983. Contract AC09-76SR00001. 27p. NTIS, PC A03/MF A01. Order Number DE83013426.

Bench-scale studies with actual dissolved irradiated light water reactor (LWR) fuels showed that continuous centrifugation is a practical clarification method for reprocessing. Dissolved irradiated LWR fuel was satisfactorily clarified in a bench-scale, continuous-flow bowl centrifuge. The solids separated were successfully reslurried in water. When the reslurried solids were mixed with clarified centrate, the resulting suspension behaved similar to the original dissolver solution during centrifugation. Settling rates for solids in actual irradiated fuel solutions were measured in a bottle centrifuge. The results indicate that dissolver solutions may be clarified under conditions achievable by available plant-scale centrifuge technology. The effective particle diameter of residual solids was calculated to be 0.064 microns for Oconee-1 fuel and 0.138 microns for Dresden-1 fuel. Filtration was shown unsuitable for clarification of LWR fuel solutions. Conventional filtration with filter aid would unacceptably complicate remote canyon operation and maintenance, might introduce dissolved silica from filter aids, and might irreversibly plug the filter with dissolver solids. Inertial filtration exhibited irreversible pluggage with nonradioactive stand-in suspensions under all conditions tested.

**38502 (DP—1657) Reprocessing RERTR silicide fuels.** Rodrigues, G.C.; Gouge, A.P. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). May 1983. Contract AC09-76SR00001. 19p. NTIS, PC A02/MF A01. Order Number DE83013804.

The Reduced Enrichment Research and Test Reactor Program is one element of the United States Government's nonproliferation effort. High-density, low-enrichment, aluminum-clad uranium silicide fuels may be substituted for the highly enriched aluminum-clad alloy fuels now in use. Savannah River Laboratory has performed studies which demonstrate reprocessability of spent RERTR silicide fuels at Savannah River Plant. Results of dissolution and feed preparation tests and solvent extraction processing demonstrations with both unirradiated and irradiated uranium silicide fuels are presented.

**38503 (ORNL/TM—8731) Consolidated Fuel Reprocessing Program. Progress report, January 1-March 31, 1983.** (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 43p. NTIS, PC A03/MF A01. Order Number DE83013727.

All research and development on fuel reprocessing in the United States is managed under the Consolidated Fuel Reprocessing Program centered at Oak Ridge National Laboratory. Technical progress is reported in overview fashion on the following: Breeder Reprocessing Engineering Test (BRET) project; process and engineering R and D; engineering systems; Integrated Equipment Test (IET) facility operations; instrumentation and controls; HTGR fuel reprocessing; and strategic planning and analysis.

**38504 (LA-tr—83-9) Development of $F_2$ two-step fluorination process for non-aqueous reprocessing.** (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Fuel Reprocessing Lab.). 1983. Contract W-7405-ENG-36. C;JAERI-M—6393. 41p. NTIS MF A01. Order Number DE83013484.

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To establish the $F_2$ two-step fluorination for stable and high recoveries of plutonium, the fluorination process has been studied with the simulated fuel to a FBR containing $UO_2$-$PuO_2$ and nonradioactive fission products in the 2-in.-diam fluid-bed. The process principle was demonstrated and the effect of fission products on fluorination of U and Pu and the possibility of reducing the Pu loss could be clarified. The feasibility of separating $PuF_6$ from $UF_6$ onto $UO_2F_2$ by adsorption, was also indicated.

**38505 Apex nuclear fuel cycle for production of light water reactor fuel and elimination of radioactive waste.** Steinberg, M.; Hiroshi, T.; Powell, J.R. (Brookhaven National Laboratory Department of Nuclear Engineering, Upton, New York 11973). *Nuclear Technology;* **58**: No. 3, 437-446(Sep 1982).

The development of a nuclear fission fuel cycle is proposed that eliminates all the radioactive fission product (FP) waste effluent and the need for geological age high-level waste storage and provides a longterm supply of fissile fuel for a light water reactor (LWR) economy. The fuel cycle consists of reprocessing LWR spent fuel (1 to 2 yr old) to remove the stable nonradioactive FPs (NRFPs) e.g., lanthanides, etc.) and short-lived FPs (SLFP) (e.g., half-lives of $\leq$ 1 to 2 yr) and returning, in dilute form, the long-lived FPs (LLFPs) (e.g., 30-yr half-life cesium and strontium, 10-yr krypton, and 16 X $10^6$-yr iodine) and the transuranics (TUs) (e.g., plutonium, americium, curium, and neptunium) to be refabricated into fresh fuel elements. Makeup fertile and fissile fuel (FF) are to be supplied through the use of the spallator (linear accelerator spallation-target fuel producer). The reprocessing of LWR fuel elements is to be performed by means of the chelox process, which consists of chopping and leaching with an organic chelating reagent ($\beta$-diketonate) and distillation of the organometallic compounds formed for purposes of separating and partitioning the FPs. The stable NRFPs and SLFPs are allowed to decay to background in 10 to 20 yr for final disposal to the environment.

## 0509 Transport And Storage

*REFER ALSO TO CITATION(S) 38530, 38910, 39241, 39242, 39248*

**38506 (DOE/S—0020) Report on financing the disposal of commercial spent nuclear fuel and processed high-level radioactive waste.** Benny, R.I.; Sprecher, W.M. (USDOE Nuclear Waste Policy Act Project Office, Washington, DC). Jun 1983. 55p. NTIS, PC A04/MF A01. Order Number DE83014080.

Projected revenues generated from the 1.0 mill per kWh fee mandated by the Act are sufficient to cover the full range of reference case program costs, assuming 3% annual inflation and nuclear installed capacity of 165 gigawatts-electric by the year 2000. Total estimated costs of the reference waste disposal program, encompassing either spent nuclear fuel disposal or reprocessing waste disposal, range between $18 to 20 billion in constant 1982 dollars. Sensitivity case analyses established upper and lower program cost bounds of $28 billion and $16 billion, respectively (in 1982 dollars). In terms of discounted levelized unit costs, the disposal of spent fuel equates to $122 to 125 per kilogram (uranium) compared with $115 to 119 per kilogram for the reprocessing waste equivalent. The levelized unit costs for reprocessing exclude the solidification of liquid wastes. Such costs are estimated to be $8 per kilogram. Discounted levelized unit costs corresponding to the upper and lower limits of the sensitivity cases equate to $176 per kilogram and $107 per kilogram. The 1.0 mill per kWh fee will be reviewed annually and adjusted, if necessary, to accommodate changes in program costs due to inflation and program shifts. When adjustments are made for applicable discount rates, inflation, repository design changes, and other factors, levelized unit costs for the reference case presented in this analysis agree closely with the results of two previous Department of Energy studies concerning charges for spent fuel storage and disposal services provided by the Federal government. The cost estimates developed for the program were based on the best available data.

**38507 (GA-A—17121) Transuranic package transporter (TRUPACT) system design status and operational support equipment.** Johanson, N.W.; Meyer, R.J.; Romesberg, L.E.; Pope, R.B. (GA Technologies, Inc., San Diego, CA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (SAND—82-1911; TTC—0340; CONF-830528—30). NTIS, PC A02/MF A01. Order Number DE83013682.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

A program was initiated in the late 1970's at Sandia National Laboratories to develop an efficient, safe, reliable, and cost-effective transportation packaging system for the carriage of contact-handled transuranic (CH-TRU) waste within the Department of Energy (DOE) complex. It is anticipated that eventually a family of TRUPACT (TRansUranic PACKage Transporter) systems having varied dimensions and weight/volume capacities will be needed by the DOE to transport different CH-TRU waste forms. Each TRUPACT system will be a Type B packaging. Large quantities of CH-TRU wastes having many different forms, isotopic contents, and contained in a variety of waste containers have been, are being, and will continue to be produced and stored for ultimate disposal. Packaging design is being closely coordinated with facility designs to ensure the rapid and economic integration of the TRUPACT system. The first packaging developed for transport by truck or rail (bimodal) is designated TRUPACT-I and will become operational in 1984. This paper provides an overview of progress on the TRUPACT-I design and details of equipment to be used for interfacing with users.

**38508 (HEDL-SA—2794-FP) Tutorial review of spent-fuel degradation mechanisms under dry-storage conditions.** Einziger, R.E. (Hanford Engineering Development Lab., Richland, WA (USA)). Feb 1983. Contract AC06-76FF02170. 24p. (CONF-830451—13). NTIS, PC A02/MF A01. Order Number DE83012825.

From American Ceramic Society annual meeting; Chicago, IL, USA (25 Apr 1983).

This tutorial reviews our present understanding of fuel-rod degradation over a range of possible dry-storage environments. Three areas are covered: (1) why study fuel-rod degradation; (2) cladding-degradation mechanisms; and (3) the status of fuel-oxidation studies.

**38509 (K/CSD/INF—82/20) Transportation data base for the US Department of Energy.** Arrowood, L.F. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. (CONF-830528—32). NTIS, PC A02/MF A01. Order Number DE83013253.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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In addition to providing rapid retrieval of large amounts of shipping and receiving data in response to inquiries and allowing remote access to the data from dial-up terminals, shipment mobil-

ity/accountability collection system (SMAC) is a central accounting system for DOE transportation activities. This facilitates the analysis of site, regional, or national traffic flow patterns thereby allowing DOE to identify frequently utilized routes and negotiate more favorable shipping contracts using the results. The data on radioactive shipments can be used for risk assessment and other research and development activities as well as to answer questions concerning such shipments. The accessibility of transportation data to traffic managers allows DOE to be more responsive to congressional, agency, and public requests for traffic information. It also assists DOE efforts to find more economical and safer methods of moving material by supplying research institutes with shipping and receiving data for participating contractors. SMAC is an example of the computer's growing importance as a managerial tool in the area of transporting both radioactive and nonradioactive materials.

38510 **(PNL-SA—10553) Materials behavior in interim storage of spent fuel.** Johnson, A.B. Jr.; Bailey, W.J.; Gilbert, E.R.; Inman, S.C. (Pacific Northwest Lab., Richland, WA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA)). 1982. Contract AC06-76RL01830. 8p. (CONF-821103—95). NTIS, PC A02/MF A01. Order Number DE83013758.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Interim storage has emerged as the only current spent-fuel management method in the US and is essential in all countries with nuclear reactors. Materials behavior is a key aspect in licensing interim-storage facilities for several decades of spent-fuel storage. This paper reviews materials behavior in wet storage, which is licensed for light-water reactor (LWR) fuel, and dry storage, for which a licensing position for LWR fuel is developing.

38511 **(PNL-SA—11135) Spent fuel shipping costs for transportation logistics analyses.** Cole, B.M.; Cross, R.E.; Cashwell, J.W. (Pacific Northwest Lab., Richland, WA (USA); Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Sandia National Labs., Albuquerque, NM (USA)). May 1983. Contract AC06-76RL01830. 11p. (CONF-830528—24). NTIS, PC A02/MF A01. Order Number DE83013250.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

Logistics analyses supplied to the nuclear waste management programs of the U.S. Department of Energy through the Transportation Technology Center (TTC) at Sandia National Laboratories are used to predict nuclear waste material logistics, transportation packaging demands, shipping and receiving rates and transportation-related costs for alternative strategies. This study is an in-depth analysis of the problems and contingencies associated with the costs of shipping irradiated reactor fuel. These costs are extremely variable however, and have changed frequently (sometimes monthly) during the past few years due to changes in capital, fuel, and labor costs. All costs and charges reported in this study are based on January 1982 data using existing transport cask systems and should be used as relative indices only. Actual shipping costs would be negotiable for each origin-destination combination.

38512 **(SAND—82-1913C) Thermal testing in support of the TRUPACT development program.** Diggs, J.M.; Yoshimura, H.R.; Uncapher, W.L. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 9p. (CONF-830528—31). NTIS, PC A02/MF A01. Order Number DE83013272.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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Thermal testing has been performed as part of development activities in support of the design of the TRUPACT (TRansUranic PACkage Transporter). The TRUPACT contains polyurethane foam in the walls and door to provide both impact and thermal protection. The environmental tests series to assess thermal protection have included radiant heating tests, small unit fire tests, and full-scale fire tests on foam bearing subsystems. To gather information on foam performance in both severe and near-regulatory environments, the polyurethane foams were tested in various configurations under fire simulation conditions. In parallel test programs, the foam underwent exposure to a radiant environment, (simulating the heat input to the foam from a fire) and exposure to an enclosed engulfing fire. The fire in this facility allowed for nearly uniform heat input in addition to approximating the chemical environment for the exposure of the unit. The test series described have led to the qualification of various foams for use in the TRUPACT on the basis of thermal performance, the benchmarking of the thermal code used to evaluate changes to the TRUPACT design, and confirmation of the basic design philosophy. From these tests it was determined that the candidate foams perform best in an anaerobic environment. For this reason, a design criterion for the puncture system was set that it shall protect the foam closest to the containment cavity from air ingress. The concern of foam exposure to air due to a puncture on the TRUPACT ends has been addressed through additional testing and analysis not discussed here.

38513 **(SAND—82-1928C) Puncture protection for the TRUPACT system.** Vigil, M.G.; Deveney, J.E.; Yoshimura, H.R.; Duffey, T.A.; Cheresh, M.H.; Zimmer, A. (Sandia National Labs., Albuquerque, NM (USA); Effects Technology, Inc., Santa Barbara, CA (USA); GA Technologies, Inc., San Diego, CA (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-830528—37). NTIS, PC A02/MF A01. Order Number DE83013766.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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Details of the puncture protection activities leading to the final design of the full-scale TRUPACT-I prototype are presented. These activities ranged from sub-scale preliminary screening tests performed on a series of candidate puncture resistant materials to quarter-scale model tests of TRUPACT-I and full-scale individual panel tests.

38514 **(SAND—82-1947C) Helium/solid powder O-ring leakage correlation experiments.** Leisher, W.B.; Weissman, S.H.; Tallant, D.R.; Kubo, M. (Sandia National Labs., Albuquerque, NM (USA); Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). 1983. Contract AC04-76DP00789. 10p. (CONF-830528—38). NTIS, PC A02/MF A01. Order Number DE83013773.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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We have developed a method to test powder leakage that has passed O-ring seals. To validate this method we have spiked a test fixture with 98 ng of U and recovered 130 +- 25 ng of U. We did not detect U at a detection limit of 26 ng in a fixture which was treated as a blank. This method has been applied to the leakage of $UO_2$ powder passing the type of EPDM O-ring seals used in a SNM shipping cask belonging to PNC. Considering the three experimental tests in which no or very small quantities of U were detected as effective blank test, it appears that the level of external contamination is negligible. Therefore, we believe that the U quantities greater than 26 ng (6 tests) passed the primary O-ring seal. From this limited quantity of data, we observe no apparent correlation between the amount of U measured and either helium leak rate or equivalent tube diameter. The data for the 130°C tests indicate the possibility of a U/time relationship; however, more data are needed for verification.

38515 **(SAND—82-1992C) SSITS cask - a capsule transportation system.** Sutherland, S.H.; Eakes, R.G.; Kempka, S.N. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830528—36). NTIS, PC A02/MF A01. Order Number DE83013631.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

The Sewage Solids Irradiator Transportation System (SSITS) cask is a Type B packaging currently under development at Sandia National Laboratories for the Beneficial Uses of Nuclear

Waste Program of the US Department of Energy. It will transport radioactive source capsules to facilities such as sewage and food irradiators. Source materials for the Beneficial Uses facilities include capsules of either radioactive cesium chloride or strontium fluoride. The capsules, presently, are prepared and stored at the Waste Encapsulation and Storage Facility at Hanford, WA. Each source is doubly encapsulated. The inner cylindrical capsule is made from Hastelloy C-276 for the strontium fluoride and 316-L stainless steel for the cesium chloride. For both source types, the outer capsule is fabricated from 316-L stainless steel. The capsule assemblies are approximately 7 cm in diameter, 53 cm long, and weigh about 8 kg. Cesium chloride capsules initially contain 70 kCi of Cs-137 and have a thermal output exceeding 300 Watts. The strontium fluoride capsules produce about 950 Watts and are loaded with 150 kCi of Sr-90. The SSITS cask can transport sixteen cesium or six strontium capsules at a time.

38516 **(SAND—82-1995C) Special requirements for shipping plutonium.** Shirley, C.G.; Wilmot, E.L.; McClure, J.D.; Reese, R.T. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-830528—33). NTIS, PC A02/MF A01. Order Number DE83013669.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

The basis for shipping plutonium with single containment is discussed. In general, the Federal Register notice of June 17, 1974, which established 10CFR71.42, provides the basis for allowing shipment of plutonium without double containment. Specific details are given.

38517 **(SAND—82-1996C) Simple risk analysis tool for estimating release fractions from shipments of 55-gallon drums involved in transportation accidents.** Shirley, C.G. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 9p. (CONF-830528—39). NTIS, PC A02/MF A01. Order Number DE83013767.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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Curve-fitting techniques have been used to derive simple mathematical expressions for: (1) the force the drums are subjected to as a function of accident severity, based upon the range of breach force assigned to the eight accident severity categories; (2) radial drum crush as a function of static load; and (3) radial drum crush as a function of drum position in an array subjected to a given crush force. This paper describes how these expressions can be used collectively to estimate the fraction of drums in shipment that are breached as a function of accident severity. Then using assumed values for the fraction of the contents that escape from a breached drum, revised release fractions have been estimated.

38518 **(SAND—82-1997C) Transportation system preconceptual description for subseabed disposal of highlevel waste.** Shirley, C.G.; McClure, J.D.; Miller, M.; Chryssostomidis, C.; Giovanetti, R.C.; Wee, C.S. (Sandia National Labs., Albuquerque, NM (USA); Massachusetts Inst. of Tech., Cambridge (USA)). 1983. Contract AC04-76DP00789. 9p. (CONF-830528—29). NTIS, PC A02/MF A01. Order Number DE83013684.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

In support of an environmental assessment of the subseabed concept for nuclear waste disposal, which is being evaluated in the US Department of Energy (DOE) Subseabed Disposal Program (SDP), a preconceptual description has been developed for land and sea transportation systems and for a port facility where the land and sea systems interface. The complete system has a reference capacity for shipping and disposing of the commercial high-level waste (CHLW) generated from reprocessing 3000 MTHM/yr of spent reactor fuel elements (~ 1950 canisters/yr). Two scenarios are considered: (1) A 1500 MTHM/yr reprocessing plant located in the Southeast US shipping to an East coast port 500 miles away from which the waste is transported to an Atlantic disposal site; and a 1500 MTHM/yr reprocessing plant located in the Northwest US shipping to a West coast port 500 miles away from which the waste is transported to a Pacific disposal site. (2) A 3000 MTHM/yr reprocessing plant located in the Southeast US shipping 50% of the CHLW produced to an East coast port 500 miles away for disposal in the Atlantic and shipping the other 50% to a West coast port 2000 miles away for disposal in the Pacific.

38519 **(SAND—83-0196C) Assessment of the safety of spent fuel transportation in urban environs.** Sandoval, R.P. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 7p. (CONF-830528—34). NTIS, PC A02/MF A01. Order Number DE83013670.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

This report describes the results of a program conducted at Sandia National Laboratories (SNL) to provide the experimental data base for estimating the radiological consequences from a hypothetical sabotage attack on a spent fuel shipping cask. The primary objectives of the program were limited to (1) evaluating the effectiveness of selected high energy devices in breaching full-size spent fuel casks, (2) quantifying and characterizing relevant aerosol properties of the released fuel, and (3) using the resulting experimental data to evaluate the radiological health consequences resulting from a hypothetical sabotage attack on a spent fuel shipping cask in a densely populated area. Subscale and full-scale experiments in conjunction with an analytical modeling study were performed to meet the programmatic objectives.

38520 **(SAND—83-0898C) Perception of risks in transporting radioactive materials.** Shepherd, E.W.; Reese, R.T. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 7p. (CONF-830528—26). NTIS, PC A02/MF A01. Order Number DE83013271.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

A framework for relating the variables involved in the public perception of hazardous materials transportation is presented in which perceived risk was described in six basic terms: technical feasibility, political palatability, social responsibility, benefit assessment, media interpretation, and familiarity as a function of time. Scientists, the media and public officials contribute to the discussion of risks but ultimately people will decide for themselves how they feel and what they think. It is not sufficient to consider the public of not being enlightened enough to participate in the formulation of radioactive material transport policy. The framework provides the technologist with an initial formulation to better inform the public and to understand public perception.

38521 **(UCID—19814) Bread: CDC 7600 program that processes Spent Fuel Test Climax data.** Hage, G.L. (Lawrence Livermore National Lab., CA (USA)). Apr 1983. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01. Order Number DE83013703.

BREAD will process a family of files copied from a data tape made by Hewlett-Packard equipment employed for data acquisition on the Spent Fuel Test-Climax at NTS. Tapes are delivered to Livermore approximately monthly. The process at this stage consists of four steps: read the binary files and convert from H-P 16-bit words to CDC 7600 60-bit words; check identification and data ranges; write the data in 6-bit ASCII (BCD) format, one data point per line; then sort the file by identifier and time.

38522 **A mechanistic analysis of ruthenium transport in $UO_2$.** Olander, D.R. (University of California, Lawrence Berkeley Laboratory and Department of Nuclear Engineering, Materials and Molecular Research Division, Berkeley, California 94720). *Nuclear Science and Engineering;* **82**: No. 2, 190-205(Oct 1982).

A detailed model of the interaction of ruthenium and urania is developed and compared to experimental data. The mechanism involves physical solution of the metal in the grain boundaries of the ceramic followed by simultaneous diffusion and chemical reac-

tion to produce $URu_3$ intergranular inclusions. The process occurs only when the oxide is substoichiometric, the reduction being effected by oxygen absorption by the refractory metal crucible containing the specimen. Reaction ceases when the $URu_3$ product in the grain boundary reaches a thickness that prevents removal of the other reaction product, oxygen. Fitting the model predictions to the isothermal ruthenium spreading data from a source plane of the metal held between oxide pellets provides quantitative estimates of the parameters of the model. The theory also correctly predicts the shape and magnitude of ruthenium migration in $UO_2$ in a temperature gradient, in which thermal diffusion does not appear to play a significant role.

## 0510 Marketing And Economics

*REFER ALSO TO CITATION(S) 38426, 38506, 38511, 38530*

## 0520 Waste Management

*REFER ALSO TO CITATION(S) 38506, 38518, 38559, 38560, 38561, 38563, 38564, 38565, 38566, 38567, 38568, 38569, 38936, 39141, 39372, 39380, 39450, 39458, 39459, 39468, 39471, 39472, 39473, 39474, 39475, 39476*

38523 **(AERE-M—3269) Annual discharges of certain long-lived radionuclides to the sea and to the atmosphere from the Sellafield Works, Cumbria 1957-1981.** Cambray, R.S. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Sep 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702047.

Because of the continuing interest in the behaviour of radioactive material discharges to the sea and to the atmosphere from the Sellafield Works of British Nuclear Fuels Limited, an attempt has been made to list the published figures and to bring them together in one document. Wherever possible the data have been taken directly from the publications of British Nuclear Fuels Limited or its predecessor the United Kingdom Atomic Energy Authority. Secondary references have used data supplied by BNFL.

38524 **(CONF-830523—11) Status and strategy of the U.S. commercial waste management program. Consolidated Fuel Reprocessing Program.** Croff, A.G.; Jubin, R.T. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01. Order Number DE83012639.

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

Management of airborne waste generally involves the following steps: recovery, treatment, interim storage, transportation, and disposal. The recovery (retention) of airborne radionuclides is generally well developed since the first-generation processes have been used for iodine and particulates for decades by the DOE nuclear materials production plants. Later-generation processes have been carried separately through the cold pilot-plant stage. However, the design and demonstration of a hot, integrated flowsheet for the recovery of all airborne species to the extent necessary to meet applicable regulations are still required. Treatment of the recovered airborne wastes is generally less-well developed. Tentatively preferred processes have been identified: iodine-barium iodate and/or silver zeolites in concrete with additives; krypton-implanted as ions in a metal alloy and encapsulated in concrete; carbon-barium carbonate in concrete with additives; particulates-encapsulation of HEPA filters in concrete; ruthenium-ruthenium traps encapsulated in concrete. The technology for interim storage and transportation appears to be straightforward engineering extensions of existing technology, assuming that the waste forms listed above are to be employed. Waste disposal concepts are the least well-developed aspect of airborne waste mangement technology. It appears that the long-lived materials such as $^{129}I$, $^{14}C$, and particulates will have to be emplaced in a geologic repository and that shorter-lived airborne waste may be acceptable in shallow-land burial grounds. The long-range goal of the program is to determine all of the steps necessary to manage airborne wastes.

38525 **(DOE/DP—0015) Defense waste management plan.** (USDOE Assistant Secretary for Defense Programs, Washington, DC). Jun 1983. 48p. NTIS, PC A03/MF A01. Order Number DE83013816.

Defense high-level waste (HLW) and defense transuranic (TRU) waste are in interim storage at three sites, namely: at the Savannah River Plant, in South Carolina; at the Hanford Reservation, in Washington; and at the Idaho National Engineering Laboratory, in Idaho. Defense TRU waste is also in interim storage at the Oak Ridge National Laboratory, in Tennessee; at the Los Alamos National Laboratory, in New Mexico; and at the Nevada Test Site, in Nevada. (Figure E-2). This document describes a workable approach for the permanent disposal of high-level and transuranic waste from atomic energy defense activities. The plan does not address the disposal of suspect waste which has been conservatively considered to be high-level or transuranic waste but which can be shown to be low-level waste. This material will be processed and disposed of in accordance with low-level waste practices. The primary goal of this program is to utilize or dispose of high-level and transuranic waste routinely, safely, and effectively. This goal will include the disposal of the backlog of stored defense waste. A Reference Plan for each of the sites describes the sequence of steps leading to permanent disposal. No technological breakthroughs are required to implement the reference plan. Not all final decisions concerning the activities described in this document have been made. These decisions will depend on: completion of the National Environmental Policy Act process, authorization and appropriation of funds, agreements with states as appropriate, and in some cases, the results of pilot plant experiments and operational experience. The major elements of the reference plan for permanent disposal of defense high-level and transuranic waste are summarized.

38526 **(DOE/EP—0088) Guide for disposition of radioactive-material sources.** Taylor, J.M.; Selby, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC06-76RL01830. 65p. NTIS, PC A04/MF A01. Order Number DE83012960.

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This guide has been prepared to assist DOE Energy Technology Centers in disposing of radioactive-material sources. The guide describes the steps and requirements necessary to dispose of unwanted sources. The steps include obtaining approvals, source characterization, source disposition, packaging requirements, and shipment preparation. A flow chart is provided in the guide to assist the user in the necessary sequential steps of source disposition.

38527 **(DOE/ID/12305—T1) Low-level radioactive waste project. Final report.** (USDOE Idaho Operations Office, Idaho Falls). 1982. Contract FG07-81ID12305. 68p. NTIS, PC A04/MF A01. Order Number DE83013061.

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This report summarizes work of the US Conference of Mayors project, Local Government Review of Approaches to Management of Low-Level Radioactive Wastes. The work covered the time between April 1, 1981 and September 30, 1982, and was carried out in two phases. The objective of the first phase was to have local government officials review DOE's proposed low-level radioactive waste management program strategy document. Towards this end, the Conference was to organize meetings to obtain such review, to convey information to local representatives on policy and technical issues associated with low-level waste management, and to provide EG and G Idaho, Inc. (EG and G), the operator of DOE's Idaho Operations Office, with reports on those meetings. Because of the compression of time, funds remained unspent at the end of the first phase. After discussion, both the Conference and EG and G agreed it would be mutually beneficial to re-allocate funds within categories of the original budget, and to extend the project. The purpose of the extention was to permit follow-up to issues and suggestions raised at the Strategy Review Meetings. These included the need to monitor the on-going process of implementing the Low-Level Radioactive Policy Act, and to provide more mayors with information about the issues of low-level radioative waste disposal. As agreed, the tasks under this extension

have involved preparation of three information packets for mayors, and briefings for staff of other local government associations.

38528 **(DOE/LLW—3) Public comment on managing low-level radioactive wastes: a proposed approach.** (EG and G Idaho, Inc., Idaho Falls (USA)). May 1983. Contract AC07-76ID01570. 222p. NTIS, PC A10/MF A01. Order Number DE83013941.

This supplement to the final version of Managing Low-Level Radioactive Wastes: A Proposed Approach (DOE/LLW-9) reprints the public comments received on the draft issued in August 1980. More than 600 separate comments were received from some 70 groups and individuals during a 10-month review period. These comments, and responses to them, appear on the following pages. It was not necessary or possible to respond to every comment. The comments, organized by topic area, were reviewed by National Low-Level Waste Management Program staff and the Strategy Task Force at its final meeting in September 1981. Many changes in the draft document were made in response to public comment; these changes are noted in responses to the relevant comments. It was decided to print the final policy document without expressly noting the changes that were made. This supplement should assist in further explaining the low-level waste policy issues that appear in the final document.

38529 **(DOE/LLW—18T-Rev.1) Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Mangement Program.** (EG and G Idaho, Inc., Idaho Falls (USA)). May 1983. Contract AC07-76ID01570. 495p. NTIS, PC A21/MF A01. Order Number DE83013155.

This is the first quarterly update of Radioactive Waste Management: A Summary of State Laws and Administration. Because states have been very active on waste management issues, the whole report is being reissued in this update. It covers the administration, the legislature and the laws in the 50 states related to radioactive waste. The report for each state is divided into four sections: Cover Page; Administrative; Legislative; and Applicable Legislation. The cover page indicates whether or not it is an Agreement State, the low-level waste compacts in which the state is listed as an eligible state, and the high-level waste repository site screening regions in which the state or a portion of it is located. The administrative section provides information on the governor, lead agencies, other involved administrative agencies, relevant commissions, boards and councils and various contacts. The Legislative section provides general information on the legislature and lists legislative leaders, the relevant committees and their chairs and a legislative contact. In the section covering Applicable Legislation, laws related to radiation protection, low-level waste and high-level waste have been summarized. Hazardous waste siting laws are included for states that do not have a siting law covering radioactive waste. The section also contains summaries of relevant bills introduced in 1982 and 1983 legislative sessions and their disposition. In general, the information in this report is accurate as of 15 April 1983.

38530 **(DOE/S—0019) Fund management plan.** (USDOE Nuclear Waste Policy Act Project Office, Washington, DC). May 1983. 25p. NTIS, PC A02/MF A01. Order Number DE83012883.

The Nuclear Waste Policy Act of 1982, P.L. 97-425 (the Act), provides for establishment of two separate special funds in the US Treasury, the Interim Storage Fund and the Nuclear Waste Fund (the Funds). The Interim Storage Fund (Sec. 136) is the financing mechanism for the provision of federal interim storage capacity, not to exceed 1900 metric tons, for spent nuclear fuel (SNF) from civilian reactors. Basically, interim storage of SNF is the responsibility of the owners and generators of nuclear wastes. Storage at government facilities will be provided only if the utilities do not have adequate storage capacity. The Nuclear Waste Fund (Sec. 302) is the statutory financing approach for the Department's radioactive waste disposal program. P.L. 97-425 directs utilities to pay a mandatory fee to cover DOE's expected costs for nuclear waste disposal. The Funds are administered by the Department of Energy. This Plan identifies how DOE will implement and manage the Nuclear Waste and Interim Storage Funds.

38531 **(DP-MS—82-104) Incineration demonstration at Savannah River.** Lewandowski, K.E.; Becker, G.W.; Mersman, K.E.; Roberson, W.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 5p. (CONF-830205—31). NTIS, PC A02/MF A01. Order Number DE83013679.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

A full-scale incineration process for Savannah River Plant (SRP) low level beta-gamma combustible waste was demonstrated at the Savannah River Laboratory (SRL) using nonradioactive wastes. From October 1981 through September 1982, 15,700 kilograms of solid waste and 5.7 $m^3$ of solvent were incinerated. Emissions of off-gas components (NO/sub x/, $SO_2$, CO, and particulates) were well below South Carolina state standards. Volume reductions of 20:1 for solid waste and 7:1 for Purex solvent/lime slurry were achieved. Presently, the process is being upgraded by SRP to accept radioactive wastes. During a two-year SRP demonstration, the facility will be used to incinerate slightly radioactive (<900 $\mu Ci/meter^3$) solvent and suspect level (<1 mR/hr at 0.0254 meter) solid wastes.

38532 **(DP-MS—83-17) Effect of spray calcination conditions on Synroc-D crystalline phases.** Pickett, J.B.; Allender, J.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 16p. (CONF-830451—16). NTIS, PC A02/MF A01. Order Number DE83013680.

From American Ceramic Society annual meeting; Chicago, IL, USA (25 Apr 1983).

Spray calcination conditions modified the crystalline phase composition formed during hot pressing of Synroc-D. The final desired phases can be controlled by the choice of calciner temperature and atomizing gas. A subsequent stage of redox calcination should not be required prior to hot pressing.

38533 **(DP-MS—83-30) TRU-waste decontamination and size reduction review, June 1983, US DOE/PNC technology exchange.** Becker, G.W. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 21p. NTIS, PC A02/MF A01. Order Number DE83012414.

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A review of transuranic (TRU) noncombustible waste decontamination and size reduction technology is presented. Electropolishing, vibratory cleaning, and spray decontamination processes developed at Battelle Pacific Northwest Laboratory (PNL) and Savannah River Laboratory (SRL) are highlighted. TRU waste size reduction processes at (PNL), Los Alamos National Laboratory (LANL), the Rocky Flats Plant (RFP), and SRL are also highlighted.

38534 **(DP-MS—83-55) Savannah River Plant overview.** Morris, O.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 16p. (CONF-830650—1). NTIS, PC A02/MF A01. Order Number DE83013340.

From FRG/US workshop on size reduction and decontamination facilities; Karlsruhe, F.R. Germany (27 Jun 1983).

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The Savannah River Plant (SRP) is located in the state of South Carolina. SRP's primary function is the production of plutonium, tritium, and other special nuclear materials for the national defense, for other governmental uses, and for some civilian purposes. The liquid high-level wastes produced from these operations are shown. Fission products from the separations plants are sent to underground waste storage tanks where the volume and mobility of the wastes are decreased by evaporation. Solid wastes generated by the facilities are sent to a 195-acre burial ground. The beta-gamma and low-level alpha wastes are buried in trenches. TRU wastes estimated to contain > 10 nCi/g are stored retrievably on pads. The long-range plan for managing TRU waste at SRP is shown graphically.

**38535 (EGG—2263) Induction melting of simulated transuranic waste.** Tenaglia, R.D.; McCall, J.L. (Battelle Columbus Labs., OH (USA)). Jun 1983. Contract AC07-76ID01570. 97p. NTIS, PC A05/MF A01. Order Number DE83013837.

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Coreless induction melting was investigated as a method to melt and consolidate waste material representative of the transuranic waste (TRU) stored at the Idaho National Engineering Laboratory (INEL). Waste material was introduced onto the surface of a molten cast iron bath in a coreless induction furnace. Waste metallics were incorporated into the bath. Noncombustibles formed a slag which was poured or skimmed from the bath surface. Stack sampling was performed to characterize the off-gas and particulate matter evolved. Experimental melting tests were performed for a variety of types of wastes including metallics, chemical sludge, soil, concrete, and glass. Each test also included a representative level of combustible materials consisting of paper, wood, cloth, polyvinyl chloride and polyethylene. Metallic wastes were readily processed by induction melting with a minimum of slag production. Test waste consisting primarily of chemical sludge provided fluid slags which could be poured from the bath surface. Processing of wastes consisting of soil, concrete, or glass was limited by the inability to achieve fluid slags. It appears from test results that coreless induction melting is a feasible method to process INEL-type waste materials if two problems can be resolved. First, slag fluidity must be improved to facilitate the collection of slags formed from soil, concrete, or glass containing wastes. Secondly, refractory life must be further optimized to permit prolonged processing of the waste materials. The use of a chrome-bearing high-alumina refractory was found to resist slag line attach much better than a magnesia refractory, although some attack was still noted.

**38536 (EPRI-NP—3112) Criteria definition for LLW solidification and containerization. Final report.** Ensminger, D.A.; Kaplan, M.F. (Analytic Sciences Corp., Reading, MA (USA)). May 1983. 95p. NTIS, PC A05/MF A01. Order Number DE83902226.

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The objective is to define minimum performance standards for low-level waste (LLW) solidification and containerization technologies and to assess the state-of-the-art of those technologies. The major conclusion is that there is no compelling evidence indicating that current LLW solidification and containerization technologies are inadequate to protect the public health and safety. The technical approach to this study consists of choosing a set of parameters for a reference burial site, modeling key dose pathways to man, and deriving necessary waste-form leach rates and container lifetimes from dose limits specified in draft 10 CFR Part 61. The work concludes that only four radionuclides out of the 25 buried in the site require treatment or control measures of any kind to limit their dose. Two of these nuclides (H-3 and C-14) are generated almost entirely by non-fuel-cycle facilities, and the remaining two (Tc-99 and I-129) can have their dose limited to required levels by the use of an advanced waste form or improved site management practices.

**38537 (NUREG/CR—3087) Incineration of a typical LWR combustible waste and analysis of the resulting ash.** Treat, R.L.; Lokken, R.O.; Schliebe, M.J. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 73p. (PNL—4563). NTIS, PC A04/MF A01. Order Number DE83012978.

In this study 4540 kg (10,000 lb) of simulated nuclear power plant combustion wastes were burned in a controlled-air incinerators. The purpose of this work was to generate ashes suitable for solidification, the products of which will be analyzed to determine if they are suitable for disposal. Two different types of waste were burned: resin and simulated crud, and general trash (paper, plastics, wood, rubber, and cloth). Volume-reduction ratios (unburned waste: ash) were 13:1 and 22:1, respectively. Approximately 20% of the ash was lost due to adherence to incinerator walls and entrainment in the off-gas stream. Losses of the volatile species cesium and iodine were 79% and 100%, respectively. The ashes were not hygroscopic, but they exhibited a pH of 4.6 to 5.0 when water was added. Corrosion of mild steel drums would occur within this pH range. The ashes contained a significant quantity of clinkers having lengths as great as 20 cm (8 in.). Most of the clinkers were fully incinerated and easy to crush, suggesting that standard comminuting equipment should be effective in reducing the size of clinkers to allow their solidification with the fine ashes.

**38538 (ONWI—462) Conceptual waste package interim performance specifications for waste forms for geologic isolation in salt repositories.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1983. Contract AC06-76RL01830. 31p. NTIS, PC A03/MF A01. Order Number DE83013814.

The interim performance specifications and data requirements presented are applicable to all types of radioactive wastes prepared for disposal in salt geologic repositories. In this document, an interim numerical value is provided for only one waste-form parameter - the waste-form release rate. This is the key waste-form parameter affecting waste isolation, and is defined here for spent fuel, defense high-level waste (HLW), and commercial HLW. The waste-form performance specifications and data requirements respond to the waste package performance criteria. Subject areas treated include: containment and controlled release, operational period safety, criticality control, identification, and waste-package performance testing requirements. This document was generated for use in the development of conceptual waste-package designs in salt. It will be revised as additional data, analyses, and regulatory requirements become available.

**38539 (ONWI—464) Conceptual waste package interim product specifications and data requirements for disposal of borosilicate glass defense high-level waste forms in salt geologic repositories.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Jun 1983. Contract AC06-76RL01830;AC02-83CH10140. 42p. NTIS, PC A03/MF A01. Order Number DE83013902.

The conceptual waste package interim product specifications and data requirements presented are applicable specifically to the normal borosilicate glass product of the Defense Waste Processing Facility (DWPF). They provide preliminary numerical values for the defense high-level waste form parameters and properties identified in the waste form performance specification for geologic isolation in salt repositories. Subject areas treated include containment and isolation, operational period safety, criticality control, waste form/production canister identification, and waste package performance testing requirements. This document was generated for use in the development of conceptual waste package designs in salt. It will be revised as additional data, analyses, and regulatory requirements become available.

**38540 (ONWI—473) Geochemical models suitable for performance assessment of nuclear waste storage: comparison of PHREEQE and EQ3/EQ6.** (INTERA Environmental Consultants, Inc., Houston, TX (USA)). Jun 1983. Contract AC06-76RL01830;AC02-83CH10140. 119p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83013899.

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Geochemical processes will significantly influence the performance of nuclear waste repositories. The computer codes EQ3/EQ6 and PHREEQE, can be used to describe these processes. They can be applied to far-field and near-field performance assessment and to evaluate data acquisition needs and test data. Both codes embody the ion-association conceptual model of solution behavior and can simulate geochemical reactions. The codes require thermodynamic data for each solid, gaseous, or dissolved chemical species being modeled. The data bases accompanying the codes are for testing purposes only and should not be applied to real problems without first being carefully examined. Five test problems have been run for code verification and demonstration. Routines to manipulate thermodynamic data were written so that each code could run with both data sets. Two problems of aqueous speciation in sea water verified the codes by comparison of results with hand calculations and illustrated the extent of the test data bases supplied. The third problem simulated the dissolution of microcline and verified both codes' ability to locate phase boundaries and simulate non-redox reaction paths. The fourth problem verified the codes' ability to follow abrupt redox changes in a reaction path simulation, while the fifth tested the temperature changing capacity

of the codes. When run with the same thermodynamic data, each code gave virtually identical results in all problems.

38541 **(PB—83-169789) R and D programme on the disposal of radioactive waste in deep geological formations: study of an argillaceous formation in Belgium. Summary of work carried out during the years, 1975-1979).** (Commission of the European Communities, Luxembourg). [nd]. 138p. NTIS, PC AE07/MF E07.

A research program has been implemented in Belgium on the safe, long-term disposal of conditioned radioactive waste in geological formations, in particular in the argillaceous deposits at Boom in the Mol region. A number of research projects have been undertaken, i.e., both experimental research in the field and in the laboratory as well as theoretical studies.

38542 **(PB—83-172775) Conditioning of the cladding of irradiated fuel elements by rolling and concreting. Final report Nov 76-Jul 80.** Frotscher, H.; Graebner, H.; Kapulla, H. (Commission of the European Communities, Luxembourg). [nd]. 178p. NTIS, PC AE08/MF E08.

A special conditioning process was investigated from 1976 to 1980 at KfK Karlsruhe for the mechanical compaction of the cladding and structural waste of irradiated fuel elements prior to their storage in caverns. The process falls into two stages, (a) the mechanical compaction of the mass and (b) its concreting to immobilize its radioactivity. A suitable concrete matrix had to be found and the chemical-physical and radiological characteristics ascertained. The process resulted in a stable product which for the most part was contamination-free. Details are given of the experimental installation, the conditioning process, the composition of the concrete, and of the tests to which the compacted, concreted product was subjected.

38543 **(PB—83-172916) Acid-digestion of plutonium contaminated wastes: results of work on process design and plutonium recovery from the residue. Final report.** Wieczorek, H.; Kemmler, G.; Muhr, G.; Plessing, J.; Stojanik, B. (Commission of the European Communities, Luxembourg). [nd]. 180p. NTIS, PC AE08/MF E08.

Two reactor types, the tray and the ring reactor, for the acid digestion of plutonium contaminated wastes were experimentally tested on a laboratory scale.

38544 **(PB—83-173153) High temperature incineration. (a) Incineration of solid wastes contaminated with plutonium. (b) densification of granules from high-temperature incineration. Final report.** van de Voorde, N.; Claes, J.; Taeymans, A.; Hennart, D.; Gijbels, J. (Commission of the European Communities, Luxembourg). [nd]. 136p. NTIS, PC AE07/MF E07.

A system has been developed for transforming a mixture of burnable and unburnable radioactive waste into a final product which is sufficiently insoluble for disposal. The treatment process is described and the plant and its auxiliary installations are detailed. Operation of the plant has been tested using inactive simulated waste and low activity beta-gamma waste. Experience gained in these tests is sumMarized. The efficiency of the gas purification line has been examined and the heat, mass and activity balances of the plant have been established. It is anticipated that the plant will reach the stage of industrial operation in the near future. Further studies have shown that a process for the densification of granules from high-temperature slagging incineration by hot-pressing is promising. The volume reduction achieved would allow for substantial savings in further waste management steps.

38545 **(PNL—4744) Portable instrumentation for quantitatively measuring radioactive contamination levels and for monitoring the effectiveness of decontamination and decommissioning activities.** Brodzinski, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76RL01830. 31p. NTIS, PC A03/MF A01. Order Number DE83013904.

Two completely portable high-resolution germanium diode spectrometer systems are described. These detectors are capable of measuring transuranics, activation products, and fission products, including $^{90}Sr$, at sensitivities below the uncontrolled release criteria. The detectors measure x-rays, gamma-rays, or bremsstrahlung radiation as required and have been calibrated for a variety of decontamination and decommissioning scenarios. A description of a new technology for the in-situ determination of $^{90}Sr$ is given.

38546 **(PNL-SA—10694) Modeling long-term aspects of nuclear waste disposal: the AEGIS experience.** Dove, F.H. (Pacific Northwest Lab., Richland, WA (USA)). 9 May 1983. Contract AC06-76RL01830. 13p. (CONF-830523—14; IAEA-CN—43/279). NTIS, PC A02/MF A01. Order Number DE83013260.

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

Modeling the long-term aspects of nuclear waste disposal has its roots in risk analysis of man-made systems like nuclear reactors. Analytical problems can be introduced into the performance assessment of a site-specific repository if an appreciation for the behavior of a natural earth system is not maintained. However, this should not preclude the application of historically useful analytical techniques like bounding strategies in favor of emerging, data-intensive techniques. The technical challenge is to apply existing technology and available data to a complex problem and produce a useful result.

38547 **(PNL-SA—10712) Evaluation of conditioned high-level waste forms.** Mendel, J.E.; Turcotte, R.P.; Chikalla, T.D.; Hench, L.L. (Pacific Northwest Lab., Richland, WA (USA); Florida Univ., Gainesville (USA)). 1983. Contract AC06-76RL01830. 21p. (CONF-830523—17). NTIS, PC A02/MF A01. Order Number DE83013368.

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

The evaluation of conditioned high-level waste forms requires an understanding of radiation and thermal effects, mechanical properties, volatility, and chemical durability. As a result of nuclear waste research and development programs in many countries, a good understanding of these factors is available for borosilicate glass containing high-level waste. The IAEA through its coordinated research program has contributed to this understanding. Methods used in the evaluation of conditioned high-level waste forms are reviewed. In the US, this evaluation has been facilitated by the definition of standard test methods by the Materials Characterization Center (MCC), which was established by the Department of Energy (DOE) in 1979. The DOE has also established a 20-member Materials Review Board to peer-review the activities of the MCC. In addition to comparing waste forms, testing must be done to evaluate the behavior of waste forms in geologic repositories. Such testing is complex; accelerated tests are required to predict expected behavior for thousands of years. The tests must be multicomponent tests to ensure that all potential interactions between waste form, canister/overpack and corrosion products, backfill, intruding ground water and the repository rock, are accounted for. An overview of the status of such multicomponent testing is presented.

38548 **(PNL-SA—11332) Low-level radioactive waste disposal in the oceans.** Templeton, W.L. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC06-76RL01830. 55p. (CONF-830597—1). NTIS, PC A04/MF A01. Order Number DE83013367.

From NOAA meeting on ocean dumping - strategies and policies; Kingston, RI, USA (2 May 1983).

A strategy for the management of the disposal of low-level radioactive wastes into coastal zones and ocean waters has developed over the past three decades. While there has been a substantial increase in the number of international and required agreements there has also been a concomitant improvement in our understanding of the ocean and the processes at work within it. This has allowed more rigorous and reliable assessments to be made of the radiological consequences. With the continued development of basic guidelines of radiological protection by the International Commission on Radiological Protection (ICRP) methodologies have been formulated to derive the fundamental scientific requirement - the relationship between disposal or release rate to the ocean and the resultant radiation dose to exposed human populations.

**38549 (PNL-SA—11379) NEA Research and Environmental Surveillance Programme related to sea disposal of low-level radioactive waste.** Ruegger, B.; Templeton, W.L.; Gurbutt, P. (Organization for Economic Co-Operation and Development, 75 - Paris (France); Pacific Northwest Lab., Richland, WA (USA); Ministry of Agriculture, Fisheries and Food, Lowestoft (UK)). May 1983. Contract AC06-76RL01830. 21p. (CONF-830523—13). NTIS, PC A02/MF A01. Order Number DE83013257.

From International conference on radioactive waste management; Seattle, WA, USA (16 May 1983).

Sea dumping operations of certain types of packaged low and medium-level radioactive wastes have been carried out since 1967 in the North-East Atlantic under the auspices of the OECD Nuclear Energy Agency. On the occasion of the 1980 review of the continued suitability of the North-East Atlantic site used for the disposal of radioactive waste, it was recommended that an effort should be made to increase the scientific data base relating to the oceanographic and biological characteristics of the dumping area. In particular, it was suggested that a site specific model of the transfer of radionuclides in the marine environment be developed, which would permit a better assessment of the potential radiation doses to man from the dumping of radioactive waste. To fulfill these objectives a research and environmental surveillance programme related to sea disposal of radioactive waste was set up in 1981 with the participation of thirteen Member countries and the International Laboratory for Marine Radioactivity of the IAEA in Monaco. The research program is focused on five research areas which are directly relevant to the preparation of more site-specific assessments in the future. They are: model development; physical oceanography; geochemistry; biology; and radiological surveillance. Promising results have already been obtained and more are anticipated in the not too distant future. An interim description of the NEA dumping site has been prepared which provides an excellent data base for this area (NEA 1983).It includes data in bathymetry, isopycnal topography, local and larger scale currents, sediment distribution and sedimentary processes, hydrochemistry, deep ocean biology and results of radiochemical analyses of sea water, sediments and biological materials. The modelling work is also well advanced allowing comparison of results obtained from different codes. After integration of the models, sensitivity analyses will provide indications for future research needs.

**38550 (RHO-RE-ST—1-P) Effects of Hanford high-level waste components on sorption of cobalt, strontium, neptunium, plutonium, and americium on Hanford sediments.** Delegard, C.H.; Barney, G.S. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Mar 1983. Contract AC06-77RL01030. 68p. NTIS, PC A04/MF A01. Order Number DE83013777.

To judge the feasibility of continued storage of high-level waste solutions in existing tanks, effects of chemical waste components on the sorption of hazardous radioelements were determined. Experiments identified the effects of 12 Hanford high-level waste-solution components on the sorption of cobalt, strontium, neptunium, plutonium, and americium on 3 Hanford 200 Area sediments. The degree of sorption of strontium, neptunium, plutonium, and americium on two Hanford sediments was then quantified in terms of the concentrations of the influential waste components. Preliminary information on the influence of the waste components on radioelement solubility was gathered. Of the 12 Hanford waste-solution components studied, the most influential on radioelement sorption were NaOH, $NaAlO_2$, HEDTA, and EDTA. The chelating complexants, HEDTA and EDTA, generally decreased sorption by complexation of the radioelement metal ions. The components NaOH and $NaAlO_2$ decreased neptunium and plutonium sorption and increased cobalt sorption. Americium sorption was increased by NaOH. The three Hanford sediments' radioelement sorption behaviors were similar, implying that their sorption reactions were also similar. Sorption prediction equations were generated for strontium, neptunium, plutonium, and americium sorption reactions on two Hanford sediments. The equations yielded values of the distribution coefficient, K/sub d/, as quadratic functions of waste-component concentrations and showed that postulated radioelement migration rates through Hanford sediment could change by factors of 13 to 40 by changes in Hanford waste composition.

**38551 (SAND—83-0247C) Design considerations for occupational exposure for a potential repository at Yucca Mountain: high-level-waste handling operations.** Dennis, A.W. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 13p. (CONF-830609—14). NTIS, PC A02/MF A01. Order Number DE83013472.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

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The present status of the NNWSI program, with respect to planned worker radiation protection during high-level waste handling operations, is presented. Information on the types and quantities of high-level waste to be sent to the facility, the casks in which this waste will be shipped to the facility, the proposed facility operating plan, and the facility design criteria as they relate to worker radiation protection are included in this paper.

**38552 (SAND—83-0516) Comparison of brines relevant to nuclear waste experimentation.** Molecke, M.A. (Sandia National Labs., Albuquerque, NM (USA)). May 1983. Contract AC04-76DP00789. 61p. NTIS, PC A04/MF A01. Order Number DE83012968.

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The ionic compositions of 18 brines used in nuclear waste-related laboratory tests or obtained from field tests are described and compared. Also described are the origin of each brine, its predominant use for laboratory testing, and its relavancy for future testing. The brines include Brines A and B (Waste Isolation Pilot Plant (WIPP)/generic), Office of Nuclear Waste Isolation (ONWI) Composite Permian Brine P and Equilibrated Permian P No. 2, Battelle Pacific Northwest Laboratory (PNL)-Sandia High-Level Waste (HLW) package interactions test brines (flow and downhole), ERDA-6 brines (flow and downhole), WIPP Inclusions No. 1 and No. 2, Materials Characterization Center (MCC) brine, German quinare Brine Q, US Geological Survey bittern NBT-6a, saturated NaCl (20° and 100°C), and standard seawater.

**38553 (UCID—18946) Climax Granite, Nevada Test Site, as a host for a rock mechanics test facility related to the geologic disposal of high level nuclear wastes.** Heuze, F.E. (Lawrence Livermore National Lab., CA (USA)). Feb 1981. Contract W-7405-ENG-48. 50p. NTIS, PC A03/MF A01. Order Number DE83013648.

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This document discusses the potential of the Climax pluton, at the Nevada Test Site, as the host for a granite mechanics test facility related to the geologic disposal of high-level nuclear waste. The Climax granitic pluton has been the site of three nuclear weapons effects tests: Hard Hat, Tiny Tot, and Piledriver. Geologic exploration and mapping of the granite body were performed at the occasion of these tests. Currently, it is the site Spent Fuel Test (SFT-C) conducted in the vicinity of and at the same depth as that of the Piledriver drifts. Significant exploration, mapping, and rock mechanics work have been performed and continue at this Piledriver level - the 1400 (ft) level - in the context of SFT-C. Based on our technical discussions, and on the review of the significant geological and rock mechanics work already achieved in the Climax pluton, based also on the ongoing work and the existing access and support, it is concluded that the Climax site offers great opportunities for a rock mechanics test facility. It is not claimed, however, that Climax is the only possible site or the best possible site, since no case has been made for another granite test facility in the United States. 12 figures, 3 tables.

**38554 (USGS-OFR—83-141) Geohydrologic and drill-hole data for test well USW H-1, adjacent to Nevada Test Site, Nye County, Nevada.** Rush, F.E.; Thordarson, W.; Bruckheimer, L. (Geological Survey, Reston, VA (USA)). 1983. Contract AI08-78ET44802. 43p. NTIS, PC A03/MF A01. Order Number DE83013550.

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This report presents data collected to determine the hydraulic characteristics of rocks penetrated in test well USW H-1. The well is one of a series of test wells drilled in and near the southwestern part of the Nevada Test Site, Nye County, Nevada, in a program conducted on behalf of the US Department of Energy. These investigations are part of the Nevada Nuclear Waste Storage

Investigations to identify suitable sites for storage of high-level radioactive wastes. Data on drilling operations, lithology, borehole geophysics, hydrologic monitoring, core analysis, ground-water chemistry and pumping and injection tests for well USW H-1 are in this report.

38555 **Projected subsurface migration of radionuclides from buried Idaho National Engineering Laboratory transuranic waste.** Humphrey, T.G.; Pope, M.C.; Smith, T.H. (EG & G Idaho, Inc., P.O. Box 1625, Idaho Falls, Idaho 83415). *Nuclear Technology;* **58**: No. 2, 136-149(Aug 1983).

The following conclusions can be drawn from the data presented. Subpit-sampling studies show that radionuclides have migrated, in extremely small concentrations, up to 1.7 m below the pit floors. The great majority of the migration has been limited to a distance of 0.6 m. The migration is believed to have resulted from flooding during 1962 and 1969, before present flood-control measures were in place. The saturated-zone modeling shows that, even if radionuclides passed immediately to the aquifer, the resulting concentrations at potential points of withdrawal would be below the concentrations allowed by current standards for drinking water. The unsaturated-zone modeling shows that only the longest lived radionuclides would migrate to the aquifer region. The concentrations would be less than those from natural occurrence or surface fallout. The unsaturated-zone modeling shows that radionuclides would migrate to the surface in concentrations less than those from natural occurrence, fallout, or past flooding. The benefits of grouting the waste, over leaving the waste as is, are limited to the shorter lived radionuclides. The benefits are negligible for the longer lived radionuclides. Retrieving the waste would reduce the concentrations of all affected radionuclides at the RWMC by a factor on the order of $10^5$, both before and after migration.

38556 **(RFP-Trans—405) Use of glass-metal compounds and ceramic materials to condition hot wastes.** Lazarev, L.N.; Kuznetsov, Yu.V.; Shashukov, E.A.; Aloi, A.S.; Kuznetsov, B.S. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Jun 1983. Contract AC04-76DP03533. Translation of IAEA-CN-43/473. 11p. NTIS, PC A02/MF A01. Order Number DE83013308.

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This report presents data on further development of means of inclusion of highly radioactive wastes and concentrates of long-lived radionuclides in glass-metal compounds and ceramic materials. It also contains data on the properties of the materials being used to produce the glass-metal compounds and the properties of ceramics based on clay-like materials.

38557 **An alternative solvent cleanup method using a hydrazine oxalate wash reagent.** Tallent, O.K.; Mailen, J.C. (Oak Ridge National Laboratory, Chemical Technology Division, P.O. Box X, Oak Ridge, Tennessee 37830). *Nuclear Technology;* **59**: No. 1, 51-62(Oct 1982).

A hydrazine oxalate ($(N_2H_5)_2C_2O_4$) solution was used as an alternative wash method for cleaning 30% tributyl phosphate–70% normal paraffin hydrocarbon solvent. Experimental evidence shows the $(N_2H_5)_2C_2O_4$ wash solutions to be as effective as hydrazine carbonate ($(N_2H_5)_2CO_3$) or sodium carbonate ($Na_2CO_3$) in cleanup of test solvents. Major advantages of the alternative method are: (a) $(N_2H_5)_2C_2O_4$ wash solutions are easier to prepare and store than are the $(N_2H_5)_2CO_3$ solutions and (b) the $N_2H^+{}_5$ and $C_2O^{2-}{}_4$ ions in spent $(N_2H_5)_2C_2O_4$ wash solutions can be decomposed into gases, whereas the sodium from $Na_2CO_3$ solutions must eventually be stored in some form as nuclear waste.

38558 **Analysis of fission gas disposition in light water reactor steady-state operation.** Villalobos, A.; Okrent, D.; Wazzan, A.R. (University of California at Los Angeles School of Engineering and Applied Science, Los Angeles, California 90024). *Nuclear Technology;* **58**: No. 3, 492-510(Sep 1982).

A model to predict fission gas behavior in irradiated uranium dioxide fuel during the steadystate operation of a nuclear reactor is developed. The basic physical phenomena encountered in analyzing the disposition of fission gas have been retained, but in a simplified form for ease of calculation. The analysis includes treatment of intragranular, grain face, and grain edge gas, and release to open spaces. The code is utilized to obtain comparison with experimental data and to perform fuel behavior studies. The sensitivity studies indicate the importance of grain face and grain edge bubble treatments in modeling fission gas. It is found that representation of release in different sections of the fuel pin is possible in a simple way by assuming evenly spaced bubbles on the edge, and that grain edge bubble interlinkage is a necessary condition for release to the open spaces. The sensitivity studies show that fission gas swelling is mainly due to grain edge bubbles. Grain face bubbles, although large in size, are few in number and contribute little to swelling. Intragranular swelling is intermediate between these two values. The code is successfully used to analyze the Westinghouse fission gas release data from the Zorita, Spain, light water reactor and data from the U.K. reactor DIDO. This success in modeling experiments suggests that the present code can be used in predicting fuel element performance, which is necessary in nuclear fuel design, safety analysis, and interpretation of experimental data on fuel element behavior.

## 0530 Environmental Aspects

*REFER ALSO TO CITATION(S) 38538, 38546, 38569, 39379, 39380*

38559 **(LBL—14842-Vol.1) Analytical performance models for geologic repositories. Volume 1.** Chambre, P.L.; Pigford, T.H.; Fujita, A.; Kanki, T.; Kobayashi, A.; Lung, H.; Ting, D.; Sato, Y.; Zavoshy, S.J. (California Univ., Berkeley (USA)). Oct 1982. Contract AC03-76SF00098. 189p. NTIS, PC A09/MF A01. Order Number DE83011626.

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This report presents analytical solutions of the dissolution and hydrogeologic transport of radionuclides in geologic repositories. Numerical examples are presented to demonstrate the equations resulting from these analyses. The subjects treated in this present report are: Solubility-limited transport with transverse dispersion (Chapter 2); Transport of a radionuclide chain with nonequilibrium chemical reactions (Chapter 3); Advective transport in a two-dimensional flow field (Chapter 4); Radionuclide transport in fractured media (Chapter 5); A mathematical model for EPA's analysis of generic repositories (Chapter 6); and Dissolution of radionuclides from solid waste (Chapter 7).

38560 **(LBL—14842-Vol.2) Analytical performance models for geologic repositories. Volume 2.** Chambre, P.L.; Pigford, T.H.; Fujita, A.; Kanki, T.; Kobayashi, A.; Lung, H.; Ting, D.; Sato, Y.; Zavoshy, S.J. (California Univ., Berkeley (USA)). Oct 1982. Contract AC03-76SF00098. 283p. NTIS, PC A13/MF A01. Order Number DE83011625.

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This report presents analytical solutions of the dissolution and hydrogeologic transport of radionuclides in geologic repositories. Numerical examples are presented to demonstrate the equations resulting from these analyses. The subjects treated in this report are: solubility-limited transport with transverse dispersion (chapter 2); transport of a radionuclide chain with nonequilibrium chemical reactions (chapter 3); advective transport in a two-dimensional flow field (chapter 4); radionuclide transport in fractured media (chapter 5); a mathematical model for EPA's analysis of generic repositories (chapter 6); and dissolution of radionuclides from solid waste (chapter 7). Volume 2 contains chapters 5, 6, and 7.

38561 **(NUREG/CR—3219-Vol.2) Post-emplacement monitoring, Subtask 1.2. Draft Technical Position. Vol. 2.** Panno, S.V. (Brookhaven National Lab., Upton, NY (USA)). May 1983. Contract AC02-76CH00016. 119p. (BNL-NUREG—51658-Vol.2). NTIS, PC A06/MF A01 - GPO $5.00 Order Number DE83013639.

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This describes the environmental conditions that should be monitored within a geologic high-level waste repository after the

waste packages have been emplaced. Waste package monitoring and testing requirements are outlined and means by which the licensee may comply with these requirements are presented. Plans of Action, in the event that the waste package monitoring system signals the existence of out-of-design or hazardous conditions, are also discussed. Finally, a review has been included of state-of-the-art instrumentation available for in-situ waste package monitoring that may be used to evaluate waste package performance.

38562 **(PNL-SA—10973) Laboratory studies on natural restoration of ground water after in-situ leach uranium mining.** Bell, N.E.; Deutsch, W.J.; Serne, R.J. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 24p. (CONF-830561—1). NTIS, PC A02/MF A01. Order Number DE83013248.

From 3. national symposium on aquifer restoration and ground water monitoring; Columbus, OH, USA (25 May 1983).

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When uranium is mined using in-situ leach techniques, the chemical quality of the ground water in the ore-zone aquifer is affected. This could lead to long-term degradation of the ground water if restoration techniques are not applied after the leaching is completed. Pacific Northwest Laboratory (PNL), is conducting an NRC-sponsored research project on natural restoration and induced-restoration techniques. Laboratory studies were designed to evaluate the ability of the natural system (ore-zone sediments and groundwater) to mitigate the effects of mining on aquifer chemistry. Using batch and flow-through column experiments [performed with lixiviant (leaching solution) and sediments from the reduced zone of an ore-zone aquifer], we found that the natural system can lower uranium and bicarbonate concentrations in solutions and reduce the lixiviant redox potential (Eh). The change in redox potential could cause some of the contaminants that were dissolved during the uranium leaching operation to precipitate, thereby lowering their solution concentration. The concentrations of other species such as calcium, potassium, and sulfate increased, possibly as a result of mineral dissolution and ion exchange. In this paper, we describe the experimentally determined mobility of contaminants after in-situ leach mining, and discuss the possible chemical process affecting mobility.

38563 **(RHO-LD—155-P) Factors affecting choice of plant species for revegetation on the Hanford Site.** Fuchs, M.R.; Cox, G.R. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Apr 1983. Contract AC06-77RL01030. 32p. NTIS, PC A03/MF A01. Order Number DE83013943.

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This study was conducted to evaluate three sites with vegetative communities whose dominant perennial grass species were Siberian wheatgrass-thickspike wheatgrass (Agropyron sibiricum-Agropyron dasytachyum), Indian ricegrass (Oryzopsis hymenoides), and Sandberg's bluegrass (Poa sandbergii), respectively. The principal objectives of the study were to determine the following: whether soil conditions influenced the establishment of these stands; the extent of these perennial grass species as members of the vegetation community on the Hanford Site prior to human influences, e.g., animal grazing, fire, construction, and excavation; and whether these perennial grasses could be established on other sites to be stabilized. The information obtained from this study has resulted in the following conclusions and recommendations: The depth of the soil to coarse sediments, the soil texture, and the percentage of gravel in the soil appear to affect the vegetation community on a site. It is recommended that Siberian, thickspike, and crested wheatgrass (Agropyron cristatum) be utilized for revegetation purposes on deep fine-textured soils of low gravel content. It is recommended that for revegetation purposes on shallow, coarse-textured or high gravel content soils, Indian ricegrass, needle and thread grass (Stipa comata), Sandberg's bluegrass, and sand dropseed (Sporobolus cryptandrus) be utilized. Greater success in stabilization/revegetation programs will be achieved if deep, fine-textured soils are utilized.

38564 **Enironmental migration of long-lived radionuclides. Proceedings of an international symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle organized by the IAEA, the CEC and the OECD NEA and held in Knoxville, USA, 27-31 July 1981.** Vienna, Austrai; International Atomic Energy Agency (1982). vp. (CONF-810722—; IAEA-SM—257).

From International symposium on migration in the terrestrial environment of long-lived radionuclides from the nuclear fuel cycle; Knoxville, TN, USA (27 Jul 1981).

Individual items in scope for the data base are processed separately. (DLC)

## 0540 Health And Safety

*REFER ALSO TO CITATION(S) 38517, 38519, 38520, 38536, 38539, 38551, 39435, 39450*

38565 **(DOE/AL/10752—23) Evaluation of the suitability of the WIPP site.** Neill, R.H.; Channell, J.K.; Chaturvedi, L.; Little, M.S.; Rehfeldt, K.; Spiegler, P. (New Mexico Health and Environment Dept., Santa Fe (USA). Environmental Improvement Div.). May 1983. Contract AC04-78AL10752. 172p. (EEG—23). NTIS, PC A08/MF A01. Order Number DE83012889.

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Determination of the suitability of the site for WIPP is only the first major phase in the evaluation of the radiological impact of the repository on the public health and safety. The Environmental Evaluation Group (EEG) will continue to independently review the design of the facility, the operational procedures, the criteria for packaging and shipment of the waste, the plans, procedures and results of the WIPP experiments, emergency preparedness, adherence to EPA and pertinent NRC regulations, and other important features of the project. EEG has concluded from existing evidence that the Los Medanos site for the WIPP project has been characterized in sufficient detail to warrant confidence in the validation of the site for the permanent emplacement of approximately 6 million cubic feet of defense transuranic waste. This conclusion is based on the assumption that the maximum surface dose rate for the unshielded remote-handled transuranic waste canisters will be 100 rem/hr with a maximum radionuclide concentration of 23 Ci/liter. The Site and Preliminary Design Validation program, through the drilling of two shafts to the selected repository level at 2160 ft below the surface and excavation of about 9000 ft of tunnels, has confirmed the interpretations made about the subsurface geological conditions at the site. For an assessment of the potential radiation effects of the nuclear waste repository on the public health and safety, it is necessary to understand the regional geological and hydrological setting. Much work has been done to understand these conditions and to address several specific issues which have arisen as a result of such studies. However, it is almost inevitable that some questions remain unanswered at a given time in the decision-making process. EEG has identified work which still needs to be done at the Los Medanos site in order to improve confidence in the worst case scenario models of possible breaches of the repository.

38566 **(PB—83-176602) Radioactive contamination at federally owned facilities. Final report.** Bernhardt, D.E.; Macbeth, P.J.; Sutherland, A.A.; Grant, M.W.; Sandquist, G.M. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)). Jun 1982. 354p. NTIS, PC A16/MF A01.

Federally-controlled facilities that are contaminated with radioactivity are listed and described. Estimates of current levels of contamination are provided and decontamination and decommissioning (DandD) procedures are discussed. All of this information has been gathered from available literature and personal contacts with individuals; no new measurements or site visits were made. Finally, estimates of amounts and activities of low-level and transuranic wastes that can be generated from DandD of federally controlled facilities are provided.

38567 **(PB—83-176610) Radioactive contamination at nuclear fuel cycle facilities. Final report.** Bernhardt, D.E.; Grant, M.W.; Rich, D.C.; Jensen, C.M.; Macbeth, P.J. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)). 1982. 231p. NTIS, PC A11/MF A01.

This report presents information to characterize uranium fuel cycle facilities (excluding reactors), levels of contamination at those facilities, and volumes and activity of wastes associated with their decontamination and decommissioning (DandD). It is one of a series of reports providing information to assist the U.S. Environmental Protection Agency in setting standards and guidelines for permissible residual levels of radioactivity from DandD. The categories of facilities covered by this report are: Uranium mines, Uranium mills, Uranium hexafluoride conversion plants, Fuel fabrication plants, including both low and high enriched uranium and mixed oxide facilities. Both active and inactive facilities are identified. The highest volumes of DandD waste (hundreds of millions of cubic meters) are associated with uranium mines, while the highest amounts of radioactivity are a result of DandD at fuel reprocessing plants.

38568 **(PB—83-178335) Characterization of contaminated nuclear sites, facilities, and materials: research and development.** (Evaluation Research Corp., Oak Ridge, TN (USA)). Feb 1983. 108p. NTIS, PC A06/MF A01.

The Environmental Protection Agency (EPA) is developing environmental protection standards for evaluating the risks and characterizing problems associated with disposal of radioactive wastes arising from decontamination and decommissioning (DandD) operations. A list of sites authorized to possess radioactive materials for independent research and development (RandD) was compiled. Available information on operations conducted at these sites was used to project the types, characteristics, and volumes of radioactive wastes likely to be generated during their decommissioning. The facilities were divided into three categories according to the operation conducted and the probability of radiological problems arising during DandD.

38569 **(PNL—4688) Assessment of single-shell tank residual-liquid issues at Hanford Site, Washington.** Murthy, K.S.; Stout, L.A.; Napier, B.A.; Reisenauer, A.E.; Landstrom, D.K. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76RL01830. 130p. NTIS, PC A07/MF A01. Order Number DE83013909.

This report provides an assessment of the overall effectiveness and implications of jet pumping the interstitial liquids (IL) from single-shell tanks at Hanford. The jet-pumping program, currently in progress at Hanford, involves the planned removal of IL contained in 89 of the 149 single-shell tanks and its transfer to double-shell tanks after volume reduction by evaporation. The purpose of this report is to estimate the public and worker doses associated with (1) terminating pumping immediately, (2) pumping to a 100,000-gal limit per tank, (3) pumping to a 50,000-gal limit per tank, and (4) pumping to the maximum practical liquid removal level of 30,000 gal. Assessment of the cost-effectiveness of these various levels of pumping in minimizing any undue health and safety risks to the public or worker is also presented.

### 0550 Regulations

*REFER ALSO TO CITATION(S) 38529*

38570 **(BNL-NUREG—33064) Coincidence technique to reduce geometry and matrix effects in assay.** Zucker, M.S.; Gozani, T.; Bernatowicz, H. (Brookhaven National Lab., Upton, NY (USA); Science Applications, Inc., Palo Alto, CA (USA)). 1983. Contract AC02-76CH00016. 11p. (CONF-830423—11). NTIS, PC A02/MF A01 - GPO. Order Number DE83013689.

From 5. symposium on safeguards and nuclear material management; Versailles, France (19 Apr 1983).

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Algebraic combinations of coincidence multiplicities can be formed which are relatively independent of detection efficiency, yet proportional to the amount of nuclear material being assayed. Considering these combinations, rather than the coincidence alone as signatures, has the demonstrable advantage that the assay results are comparatively independent of sample geometry or even matrix.

38571 **(EPRI-NP—2631-SY) Safeguarded fabrication and reprocessing (SAFAR). Executive summary.** Campbell, M.H.; Tomlinson, R.E. (Exxon Nuclear Co., Inc., Richland, WA (USA)). May 1983. 69p. NTIS, PC A04/MF A01. Order Number DE83902198.

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Design objectives are presented. Objective and subjective diversion resistant assessment methodology are described. A conceptual design was developed to reflect safeguarded goals. This concept, named SAFAR, includes a modified Purex process flowsheet coupled with a sphere-pac process for fuel fabrication. Diversion resistant features included throughout the process are highlighted. In addition to diversion resistance, the assessment section treats operating reliability and safety and economics. Further work required for SAFAR implementation is discussed.

38572 **(K/OA—5261) Gas-phase sampling of $UF_6$ cylinders in international safeguards.** Cardwell, R.G.; Younkin, J.M.; Swindle, D.W. Jr. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1983. Contract W-7405-ENG-26. 19p. (CONF-830709—7). NTIS, PC A02/MF A01. Order Number DE83013567.

From 24. annual meeting of the Institute of Nuclear Materials Management; Vail, CO, USA (10 Jul 1983).

This paper describes a method of taking gas-phase or, equivalently, vapor-phase samples from cylinders containing solid or liquid $UF_6$ for routine IAEA verification of $UF_6$ enrichment and purity, and recommends it as a general replacement for routine liquid sampling of $UF_6$ cylinders performed during IAEA verification inspections. Described is the vapor sampling method and the associated equipment used at United States gaseous diffusion enrichment facilities. Using data from field test experiments at Oak Ridge and Portsmouth Gaseous Diffusion Plants, liquid-phase and vapor-phase $UF_6$ sampling methods are compared to statistically validate the vapor-phase sampling method in determining $^{235}U$ enrichment. Savings in cost, time, and sample storage and transportation are shown, as well as a large decrease in the amount of necessary sample inventory indefinitely held out of the process. In addition, a portable gas-phase sampling cart that can be used in both process and field sampling is described.

38573 **(LA—9744-MS) Calibration of a neutron coincidence counter for measurement of the plutonium content of wet oxalate cakes.** Crane, T.W. (Los Alamos National Lab., NM (USA)). Apr 1983. Contract W-7405-ENG-36. 30p. NTIS, PC A03/MF A01. Order Number DE83013332.

A novel calibration procedure has been applied to the dual-ring thermal neutron coincidence counter used at the Los Alamos Plutonium Processing Facility to measure the plutonium content of wet oxalate cakes. The calibration uses the measured content of the plutonium oxide product and the coincidence counter response to estimate the plutonium content in up to four wet plutonium oxalate cakes. These estimated mass values are then used to calibrate the counter. The calibration calculation is iterative in determining the calibration function coefficients and plutonium masses for oxalate material.

## 06 FUSION FUELS

### 0604 Transport And Storage

38574 **Method and apparatus for storing hydrogen isotopes.** McMullen, J.W.; Wheeler, M.G.; Cullingford, H.S.; Sherman, R.H. US Patent Application 6-406,828. 10 Aug 1982. 16p. Contract W-7405-ENG-36.

An improved method and apparatus for storing isotopes of hydrogen (especially tritium) are provided. The hydrogen gas is stored as hydrides of material (for example uranium) within boreholes in a block of copper. The mass of the block is critically important to the operation, as is the selection of copper, because no

cooling pipes are used. Because no cooling pipes are used, there can be no failure due to cooling pipes. And because copper is used instead of stainless steel, a significantly higher temperature can be reached before the eutectic formation of uranium with copper occurs, (the eutectic of uranium with the iron in stainless steel forms at a significantly lower temperature).

# 07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

**38575 Radioactive decay data tables: a handbook of decay data for application to radiation dosimetry and radiological assessments.** Kocher, D.C. (Technical Information Center, Oak Ridge, Tennessee). *Nuclear Science and Engineering;* **82**: No. 4, 477(Dec 1982).

Reviews compendium containing recommended decay data for approx. 500 radionuclides of interest in nuclear medicine and fusion reactor technology or of potential importance in routine or accidental releases from the nuclear fuel cycle. Primary source of the decay data presented in this handbook is the Evaluated Nuclear Structure Data File (ENSDF), developed and maintained by the US Nuclear Data Network. Topics covered include various radioactive decay processes; evaluation process and standards of ENSDF; tables and computer code MEDLIST used to produce ENSDF tables; radiation dosimetry and radiological assessments; parent-daughter activity ratios wherever the adopted decay data may contain significant uncertainties or errors due to the lack of appropriate experimental data.

## 0703 Isotopic Power Supplies

**38576 (DPST—82-128-4) $^{238}$Pu fuel-form processes. Quarterly report, October-December 1982.** (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). May 1983. Contract AC09-76SR00001. 23p. NTIS, PC A02/MF A01. Order Number DE83013473.

A welding test in which multiple quenches are made in a single clad vent set was used to compare weld-quench cracking susceptibilities of S, V and X batches of DOP-26 iridium alloy. Results indicate that V-batch alloy is probably acceptable for production welding but use of X-batch alloy remains questionable. Analysis of fracture index of vacuum outgasses General-Purpose Heat Source (GPHS) production pellets from spring 1981 through August 1982 showed a cyclical trend in pellet fracture index. A noticeable reduction in the magnitude of the fracture index was observed starting in May 1982. However, the cyclic nature persisted. Since September 1982, the fracture index has been the lowest in production history. The cyclic pattern of the fracture index may also have been broken. ORNL has cross calibrated their contained and uncontained spark source mass spectrometers (SSMS) to ensure the results obtained with each will be correlatable with each other. SSMS analysis of iridium archive rings indicates that aluminum may be lost from the iridium clads during their two vacuum heat treatment steps. A method of measuring the surface area of both feed powder and shards using a Blaine tester is being evaluated. The results suggest that the method may be useful in correlating powder and shard properties with GPHS pellet quality.

# 08 HYDROGEN

## 0801 Production

*REFER ALSO TO CITATION(S) 38659, 38662, 38668, 38676, 38677, 38678, 38679, 38690, 38693, 39164, 39165, 39166, 39192, 39198, 39200, 39215*

**38577 (BNL—32964) Carbonaceous anode depolarizers for electrolytic hydrogen production.** McBreen, J. (Brookhaven National Lab., Upton, NY (USA)). May 1983. Contract AC02-76CH00016. 16p. (CONF-830578—3). NTIS, PC A02/MF A01. Order Number DE83013278.

From IEA workshop on electrolytic hydrogen production; Ispra, Italy (30 May 1983).

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An extensive study has been made on the use of coal as an anode depolarizer for electrolytic hydrogen production. This included development of chemical treatments, screening of electrocatalysts and use of highly acid electrolytes to enhance the anode depolarization activity of coal. Electrocatalyst studies were carried out using model compounds such as formic acid and formate. In addition, considerable analytical work was carried out to identify the electrochemical oxidation products of lignite. Several electrocatalysts were identified for the oxidation of formic acid and formate. These included underpotential deposited metal monolayers on platinum and a Pt/Pd alloy. When the latter was used in a formate-depolarized electrolyzer, hydrogen could be produced at a current density of 526mA/cm$^2$ and a cell voltage of 1.16V. Several chemical treatments of coal such as alkali carbonate hydrolysis, molten $ZnCl_2$ treatments and the use of strongly acidic electrolytes enhance the anode depolarization activity of coal. However, the current density is still low (~ 5mA/cm$^2$). Analysis of the products of lignite oxidation indicate that interesting compounds such as myristaldehyde and oleyl alcohol are formed during electrolysis.

**38578 (BNL—39235) Development of the Brookhaven National Laboratory integrated test bed for advanced hydrogen technology.** Metz, P.D. (Brookhaven National Lab., Upton, NY (USA)). May 1983. Contract AC02-76CH00016. 15p. (CONF-830578—2). NTIS, PC A02/MF A01. Order Number DE83012223.

From IEA workshop on electrolytic hydrogen production; Ispra, Italy (30 May 1983).

Brookhaven National Laboratory is developing an integrated test bed to illustrate advanced hydrogen technology. The first phase of this effort will investigate the use of solar energy to produce hydrogen from water via electrolysis. This will be done using a state-of-the-art photovoltaic array to power an advanced technology water electrolyzer. The goal of this work is to determine the optimal design for the photovoltaic-electrolyzer system, both with and without electrical grid connection. Eventually, the test bed will be used to investigate the use of other renewable energy options and related hydrogen technology advances. This paper describes the experimental system and integrated test bed facility now under development. The system operating modes and the research program plan for fiscal years 1983 to 1985 are presented. Opportunities for international cooperation are noted.

**38579** (SERI/CP—233/1723, pp 132) **Formation of dihydrogen from reduced Rh(bpy)$_3^{3+}$ and reduced methyl viologen in aqueous solution.** Hoffman, M.Z.; Mulazzani, Q.G. (Boston Univ., MA). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**38580** (SERI/CP—233/1723, pp 137) **Biophotolysis of water: the light saturation curves.** Greenbaum, E. (Oak Ridge National Lab., TN). 1982. NTIS, PC A08/MF A01. Contract W-7405-ENG-26.

In Sixth DOE solar photochemistry research conference.

**38581 Models for the photosynthetic water oxidizing enzyme. 1. A binuclear manganese(III)-$\beta$-cyclodextrin complex.** Nair, B.U.; Dismukes, G.C. (Princeton Univ., NJ). *Journal of the American Chemical Society;* **105**: No. 1, 124-125(12 Jan 1983). Contract FG02-80CS84003.

A binuclear Mn(III) model compound was synthesized by using $\beta$-cyclodextrin as a ligand. Reaction of the compound with various oxidizing agents has been investigated. The compound in 80:20 DMF-$H_2O$ was not oxidized by excess potassium ferricyanide. On treatment with two equivalents of Ce(IV), the 482-nm band was bleached. One equivalent produced only partial bleaching, with no evidence again for the intervalence transition for a Mn(III)-Mn(IV) oxidation state. Evidently a two-electron oxidation to the (IV,IV) state is preferred, with eventual decomposition of ligand or water over hours, at least in aqueous DMF and DMSO.

## 0802 Storage

*REFER ALSO TO CITATION(S) 38574*

## 0808 Properties

**38582 Experimental study of combustion in a turbulent boundary layer.** Cheng, R.K.; Bill, R.G. Jr.; Robben, F.; Schefer, R.; Talbot, L. (California, Univ., Berkeley, CA). pp 3.18-3.23 of Proceedings of symposium on turbulent shear flows, 2nd. London, England; Imperial College of Science and Technology (1979). (CONF-790721—). Contract W-7405-ENG-48.

From 2. symposium on turbulent shear flows; London, UK (2 Jul 1979).

The effect of $H_2$-Air combustion on induced turbulence in a heated boundary layer has been studied through time and space resolved measurements of velocity (laser Doppler anemometry) and density (Rayleigh scattering). From these measurements mean, rms fluctuations, probability density functions and auto-correlations were obtained by digital processing. The experimental conditions covered equivalence ratio from 0 to 0.3, wall temperature between 1100 to 1300 K and free stream velocity from 14 to 22 m/sec. A typical Reynolds number based on the free stream velocity was 3 x $10^5$. Three modes of combustion were indicated: (1) surface reaction, (2) surface reaction combined with gas phase reaction in the boundary layer, and (3) flame-like structure situated at the edge of the boundary layer. Velocity fluctuations of about 4% in the non-heated boundary layer were reduced to 2% by wall heating. Density fluctuations of 8 to 10% were observed in the heated boundary layer both with and without combustion. The maximum density gradient region of the flame-like structure was found to fluctuate at a fairly regular rate of 0.5 to 1.25 Khz depending on various conditions.

# 09 OTHER SYNTHETIC AND NATURAL FUELS

**38583 (PB—83-177584) Energy from biomass: an economic analysis of selected biomass energy issues.** Newman, L.C.; Rosenberg, J.I. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1980. 71p. NTIS, PC A04/MF A01.

Selected economic issues associated with large-scale energy production from biomass are studied. They include ethanol production from corn, the foreign trade implications of ethanol industry development and the potential for tradeoff between food and energy. Implications of a corn-to-ethanol program and the growth of corn exports are discussed along with the impact of energy prices on forest products demand, using the construction industry as a case study. The study indicates that as long as future energy demands impose countervailing price pressures on potential competitors of forest products, there is no reason to believe that wood will be priced out of the construction industry or any other markets where similar conditions apply. An external evaluation of this report was conducted by the Division of Policy Research and Analysis of the National Science Foundation and is appended to the main volume of this series.

## 0901 Hydrocarbon Fuels

*REFER ALSO TO CITATION(S) 38340, 38412, 38469, 38616, 39061, 39062*

**38584 (DOE/PC/30021—T12) Catalyst and reactor development for a liquid-phase Fischer-Tropsch process. Quarterly technical progress report, 1 October 1982-31 December 1982.** Dyer, P.N.; Pierantozzi, R.; Brian, B.W.; Bauer, J.V.; Parsons, R.L. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Mar 1983. Contract AC22-80PC30021. 42p. NTIS, PC A03/MF A01. Order Number DE83012434.

Two major tasks were continued: (1) Slurry Catalyst Development, and (2) Slurry Reactor Design Studies. The first extended slurry test was begun, using a proprietary catalyst. High selectivities and large deviations from the Schulz-Flory distribution were observed. A bulk activity 2.5 times greater than the baseline $Fe_2O_3$ was determined, with little deactivation over 450 h. Consistently low $CH_4$ yields of 3 to 5 wt %, and high $C_9$-$C_{25}$ fractions of 45 to 50 wt %, were produced at 240°C, 300 psig and 1:1 $CO/H_2$. This test is being continued with higher $CO/H_2$ ratios and operating temperatures. Parametric gas phase screening studies were concluded for two further modified conventional catalysts and the optimum preparations in terms of activity and diesel range selectivity were chosen for subsequent slurry phase testing. Gas holdup and solid concentration profiles were measured for water/silica slurries in the 5″ column, and for paraffin/silica slurries in the 12″ column, both with and without heat transfer internals. In both columns, gas holdup was found to be close to the Akita and Yoshida correlation. Very non-uniform solid concentration profiles were observed in the 2 column for the 90 to 115 μm size silica, with settling of the slurry on the distributor plate. Smaller size particles were more uniformly distributed. Heat transfer coefficients were determined in the 12″ column for paraffin/silica slurries, using seven vertical, tubular heat transfer elements. The values were in good agrement with Deckwer's correlation for the large and medium size particles, but were lower for the 0.5 to 5 μm size range. The bubble size diameter probe was successfully calibrated using a strobe technique, and data acquisition will begin next quarter.

**38585 (DOE/PC/30022—5) Slurry Fischer-Tropsch/Mobile two-stage process of converting syngas to high-octane gasoline. Quarterly report, 1 October-31 December 1981.** Kuo, J.C.W. (Mobil Research and Development Corp., Paulsboro, NJ (USA)). Jan 1982. Contract AC22-80PC30022. 31p. NTIS, PC A03/MF A01. Order Number DE83013801.

The construction of the BSU has been completed and the shakedown of the BSU has been initiated. A preliminary operating manual for the BSU has been prepared. A material balance program has also been written to handle the operating and product data obtained during the BSU operation. An improved F-T bubble-column mathematical model has been developed to include multi-component ($H_2$, CO, $CO_2$, and $H_2O$) diffusion, a complex kinetic expression for the F-T reaction, and a water-gas shift reaction. An orthogonal collocation method has been used to solve the resulting non-linear equations numerically. Kinetic constants of a precipitated Fe-catalyst have been estimated using the model based on a set of published conversion data. Parametric studies of varying superficial gas velocity, Fe-catalyst loading in the reactor slurry, and feed $H_2$/CO ratio have been performed to predict their effect on the F-T bubble-column performance.

**38586 (DOE/PC/30228—T8) New catalysts for the indirect liquefaction of coal. Quarterly technical report, February 1, 1983-April 30, 1983.** Melson, G.A. (Virginia Commonwealth Univ., Richmond (USA). Dept. of Chemistry). 1983. Contract FG22-80PC30228. 19p. NTIS, PC A02/MF A01. Order Number DE83012277.

Some ZSM-5 supported ruthenium catalysts, prepared from $Ru_3(CO)_{12}$ and the acid form of ZSM-5 have been evaluated for their ability to catalyze synthesis gas conversion. The effect of weight percentage ruthenium loading and temperature of evaluation have been studied. Liquid hydrocarbons with varying percentages of aromatics, olefins and saturates are produced. This study on the three Ru/ZSM-5 catalyst indicated that the desired product can be obtained in relatively high yields when the Ru loading and temperature are selected. The product distribution for the 7.32% and 2.88% Ru/ZSM-5 catalysts are similar; however, the products obtained from the 0.98% catalyst were different from the other two catalysts. The aromatic content for the 0.98% catalyst was consistently higher than the 2.88% and 7.32% samples. Therefore, if a gasoline high in aromatics is desired the 0.98% Ru/ZSM-5 catalyst would warrant further study. The temperature affected the yield of the oil. The peak oil production occurred around 260°C to 280°C. Thus, if the yield of the oil is the main concern the catalysts should be investigated at these two temperatures.

**38587 (DOE/PC/30228—T9) New catalysts for the indirect liquefaction of coal. Quarterly technical report, November 1, 1982-January 31, 1983.** Melson, G.A. (Virginia Commonwealth Univ., Richmond (USA). Dept. of Chemistry). 1983. Contract FG22-80PC30228. 25p. NTIS, PC A02/MF A01. Order Number DE83012191.

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Some ZSM-5 supported ruthenium (Ru/ZSM-5) catalysts have been prepared and characterized. The catalysts were prepared from $Ru_3(CO)_{12}$ and the acid form of ZSM-5 by the extraction procedure. Characterization of the catalysts has been achieved by using infrared spectroscopy, x-ray powder diffractometry, x-ray photoelectron spectroscopy, ion-scattering spectrometry and chemisorption. The chemical composition of the catalysts has been identified. It was determined that complete decomposition of the $Ru_3(CO)_{12}$ did not occur during the preparation procedure; however, calcination of the sample did cause the decomposition of the $Ru_3(CO)_{12}$ structure and agglomeration of the metal species. The metal species was determined to be $RuO_2$ for the AP and H-500 samples with particle sizes of less than 60 A for the AP catalysts and greater than 60 A for the H-500 catalysts. Therefore, the extraction technique produces a high degree of dispersion of the metal species on the AP catalyst. The characterization by ESCA indicated that the used catalysts did not have compete reduction of the metal species during the catalytic evaluation; because both $Ru^0$ and $RuO_2$ species were detected.

**38588 (ORNL/MIT—362) Hydrodynamic study of a Fischer-Tropsch bubble-column slurry reactor.** Humphreys, R.H. Jr.; Antos, A.J.; Woods, D.P. (Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice). Jun 1983. Contract W-7405-ENG-26. 48p. NTIS, PC A03/MF A01. Order Number DE83013714.

Hydrodynamic studies were performed to simulate a Fischer-Tropsch reactor in a Plexiglas column 5.08-cm ID and 183-cm tall. Hexane was used in a batch-liquid operation; nitrogen was sparged through a fritted stainless-steel disc. Bubble size was affected by axial position in the column and pore size of the gas sparger. Within experimental error, bubble size was not dependent on gas velocity. Gas holdup was expressed as a function of gas velocity by: $\epsilon/\text{sub g/} = 0.0694\ \text{U/sub g/}^{0.976}$. Four generalized correlations for predicting gas holdup were surveyed, but none were found to satisfactorily predict our data. However, data obtained from other Fischer-Tropsch systems were in good agreement with our experimental data. The presence of solids decreased gas holdup up to 50% for superficial gas velocities above 1.5 cm/s. At a gas velocity of 1.5 cm/s, the flow regime changed from bubbly flow to semiturbulent (swirling bubbly).

**38589 (PB—83-188664) Kinetics and catalysis of producing synthetic gases from biomass. Final report 7 Dec 79-6 Dec 82.** Sealock, L.J. Jr; Elliott, D.C.; Hallen, R.T. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). Dec 1982. 92p. NTIS, PC A05/MF A01.

Battelle Pacific Northwest Laboratories has conducted basic research to provide a fundamental elucidation of the kinetics, reaction sequences and pathways involved in pyrolysis and catalytic steam gasification of wood and wood components. A detailed data base describing the steam gasification in the presence and absence of catalysts was investigated in both systems. This data base provides detailed information regarding gasification rates, char formation, degradation products, gas-phase reactions, reaction mechanisms and catalytic activity. Results of this investigation have demonstrated that the use of a properly selected catalyst or combined catalyst systems can significantly influence the gasification of biomass.

**38590 Hydrodeoxygenation of phenolic components of wood-derived oil.** Elliott, D.C. (Pacific Northwest Lab., Richland, WA). *American Chemical Society, Division of Petroleum Chemistry, Preprints;* **28**: No. 3, 667-674(Mar 1983). (CONF-830303—). Contract AC06-76RL01830.

From 185. American Chemical Society national meeting; Seattle, WA, USA (20 Mar 1983).

Hydrotreatment of wood-derived oil to remove phenolic oxygen is a potential upgrading step by which such materials can be rendered compatible with current petroleum refining technology and converted to a diesel equivalent. Accordingly, the hydrodeoxygenation of model phenols and wood derived oil was studied in a batch reactor. Using phenol, a number of commercial catalysts were evaluated for performance and stability at reaction temperatures from 300 to 425°C and hydrogen pressures from 900 to 2050 psig. Product yields and analysis indicate the most efficient catalysts to be Ni (Ni 1404, Harshaw) and presulfided Co-Mo (CoMo 0402, Harshaw), based on yields of benzene and cyclohexane. Due to complications caused by the introduction of sulfur into the system, the Ni catalyst may be preferred. Alkyl phenols, napthol and guiacol were hydrotreated at 400°C and 2000 psig using an unsulfided Co-Mo catalyst. In addition to the corresponding alkylated aromatic and saturated cycloalkanes, significant yields of scrambled aromatic product, formed by dealkylation and methyl migration were observed. Guiacol hydrotreatment is complex, there being significant polymerization and dimerization: pyrolysis, not catalystic hydrodeoxygenation is the major reaction path. Wood-derived oils were partially deoxygenated and somewhat upgraded by hydrotreatment using Ni and sulfided Co-Mo catalysts.

## 0902 Alcohol Fuels

*REFER ALSO TO CITATION(S) 38876, 39078*

**38591 (AD-A—124916/8) Methanol from wood waste: a technical and economic study. Forest Service general technical report.** Hokanson, A.E.; Rowell, R.M. (Forest Products Lab., Madison, WI (USA)). Jun 1977. 23p. NTIS, PC A02/MF A01.

A methanol-from-wood waste facility having a capacity of 50 million gallons per year requires 1,500 ovendry tons (ODT) of wood waste per day. The yield of methanol from wood is about 38 percent, or about 100 gallons per ODT of wood. This yield is based on all process energy required coming from the wood waste. At a good waste cost of $15/ODT, the selling price of methanol is estimated at 0.77/gal; at $34/ODT, the selling price is $0.96/gal.

**38592 (AD-A—125063/8) Investigative study on alcohol diesel fuel blends. Final report 1 Oct 80-30 Jun 81.** Pandalai, K.; Ayoub, A.; Pandalai, B. (Pandalai Coatings Co., Brackenridge, PA (USA)). Jun 1981. 50p. NTIS, PC A03/MF A01.

The project involved characterization, storage stability and material compatibility studies of ethanol and 2 diesel fuels. Ten samples of commercially available fuels were obtained and blended with 10% ethanol which was denatured with gasolene and a solvent blend of ethyl acetate and MIBK. Anhydrous alcohol also was used to prepare a 10% blend to examine stability and material compatibility characteristics. It has been observed that the presence of small amounts of water in the alcohol causes phase Separation and great care must be taken to prevent water contamination in the fuel system. It has also been found that certain surfactants and co-solvents would stabilize the fuel blends even when water is present in the blended fuels. Results of test on stability and material compatibility are presented in this report.

**38593 (CONF-830567—1) Kinetics of ethanol production by Zymomonas mobilis.** Worden, R.M.; Donaldson, T.L.; Shumate, S.E. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE83012597.

From 5. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (10 May 1983).

The primary objective of this study was to investigate the relationship between the ethanol concentration in batch culture medium and the specific growth rate of Z. mobilis (ATCC 10988). At a glucose concentration of 5%, it was determined that specific growth and ethanol production rates are maximized at temperatures of 35 and 37°C respectively. The measured activation energy was 6 kcal/g-mol in both cases. The effects of pH were investigated at 36°C in a 5% glucose medium. Maximum cell growth rate was found over the pH range 5.6 to 7.5, and maximum ethanol production rate was apparently more sensitive to acidic conditions than were ethanol production rates. At 36°C, fermentation rates were

observed to increase with increasing glucose concentrations up to approximately 10% glucose, and then to decrease at higher glucose concentrations. Classical kinetic models could not be fit to the experimental data, suggesting that simple substrate inhibition may not be the primary mechanism responsible for the declining rates at high glucose concentrations. Batch growth experiments in ethanol-spiked medium produce data which are incompatible with simple one-inhibitor kinetic models. A model assuming the production of two inhibitors can fit this data. Such an assumption is reasonable, since Z. mobilis is known to produce small quantities of secondary products which may be inhibitory to the cells.

38594 **(DOE/ID/12327—T1) Ethyl-alcohol-fuel production from the Jerusalem artichoke. Alcohol-Fuels Grant Program.** Middaugh, P.R. (Fluke Inst. for Renewable Energy, Bellevue, WA (USA)). Mar 1983. Contract FG07-81ID12327. 34p. NTIS, PC A03/MF A01. Order Number DE83013488.

The project objective is to evaluate the commercial feasibility for production of fuel alcohol by fermentation of the carbohydrates in the tops of the Jerusalem artichoke. The maximum top biomass yields of the mammoth French white variety of Jerusalem artichoke was obtained at 119 days after plant emergence and maximum fresh weight of the tops was 31.6 tons per acre. During rapid growth the fresh stalks had 2% to 4% carbohydrate. After the plant reached a maximum height of 168 inches, and started to bud the stalk had a maximum of 4% carbohydrate. During blossoming the stalk carbohydrates rapidly translocated to the tuber. Single versus multiple cuttings demonstrated the maximum carbohydrate was obtained with a single harvest of the mature plants immediately following bud formation. The total carbohydrate yield from the top biomass was 1.26 tons per acre. The equivalent yield of fermentation alcohol is 180.6 gallons of anhydrous ethanol per acre. The tuber yield at both Mesa and Toppenish, WA, was 14 to 15 tons of fresh tubers with 18% total carbohydrates. The carbohydrate yield was 2.52 tons per acre. This is equivalent to a yield of 360 gallons of anhydrous ethanol per acre. Commercial scale fuel alcohol equipment was used to hammer mill and batch ferment tops and tubers. The steps for commercial processing of the biomass tops and tubers was discussed including extracting and fermentation of the carbohydrates to ethanol and their concentration by distillation and dehydration by molecular sieves to anhydrous fuel alcohol. The use of molecular sieves reduced the energy for dehydration of 95% ethanol to 5000 Btu per gallon. The economic feasibility and energy requirement for commercial processing was discussed.

38595 **(DOE/ID/12337—T1) Technical and economic study of ethanol distillation from low-temperature sources. Final report, 23 June 1981-22 November 1982.** Johnson, S.A. (Utah Univ., Salt Lake City (USA). Utah Engineering Experiment Station). 29 Apr 1983. Contract FG07-81ID12337. 68p. NTIS, PC A04/MF A01. Order Number DE83013073.

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The objectives of this project are to: (1) investigate the thermodynamics, mass transport, column contact efficiencies, and other operating characteristics of a distillation column operated with $CO_2$ carrier gas and with water absorption to remove alcohol vapor from recirculated $CO_2$, to facilitate operation at lower temperatures; (2) modify the column to operate under a wide range of $CO_2$ flow rates, temperatures and pressures (including partial vacuum) to study the optimum recovery of ethanol; (3) determine the vapor-liquid equilibrium concentrations for an ethanol/water/$CO_2$/ system as a function of temperature and pressure; and (4) study the economics of constructing a commerical-size ethanol distillation plant based on use of $CO_2$ carrier gas to enhance recovery of ethanol at low temperatures as a function of plant size, heat source (geothermal, industrial waste heat, fossil size, solar, etc.), column operating temperature, and column operating pressure. Data in this final report indicate that the distillation column has been operated successfully at several feed temperatures and several ethanol feed concentrations as well as under a wide range of $CO_2$ flow rates, temperatures, feed flow rates, and ethanol feed concentrations. No detectable difference was found in the concentration of ethanol in the distillate product when $N_2$ or $CO_2$ carrier gas was used. Results of the economic study indicate that the use of carrier gas is shown to cause an increase in cost in the stripper and the rectifier sections. The $CO_2$ causes a loss in the rectifier section which is significant. (DMC)

38596 **(DOE/ID/12339—T1) Alcohol dehydration using organic solids. Final report. Alcohol-Fuels Grant Program.** Hendrix, W.A.; Jape, A.D. (Georgia Inst. of Tech., Atlanta (USA). Engineering Experiment Station). Mar 1983. Contract FG07-81ID12339. 82p. NTIS, PC A05/MF A01. Order Number DE83013487.

The Technology Applications Lab of Georgia Tech Engineering Experiment Station conducted a study which investigated the important design parameters related to construction of commercial size ethanol dehydration units based on preferential adsorption of water from aqueous ethanol vapor in a fixed bed of starchy or cellulose material. A pilot unit rated at 25 gallons per hour aqueous ethanol was built and several test runs made using sorbents which had proven successful on a lab-scale. Laboratory experimentation was also performed which was aimed at a better understanding of the parameters important to the process and an assessment of the magnitude of their effect. This report details the findings of this project and includes a description of the pilot dehydration unit, the test runs that were made, data taken during and after the pilot runs, and the conclusions and recommendations which resulted.

38597 **(PB—83-177576) Energy from biomass: background and systems selection for the technology assessment.** Newman, L.C.; Johnson, R.C.; Jones, M.; Strasser, J.V. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1980. 110p. NTIS, PC A06/MF A01.

The background research and initial analysis for a technology assessment of terrestrial biomass systems in the United States between 1980 and 2010 are described. Four systems were selected for detailed description and analysis: gasohol production from corn; residential heating with wood; industrial steam and cogenerated electricity from wood or wood residues; and methanol automotive fuel from silvicultural farms. The development of key concepts that provide scope and bounding for this set of technologies is presented. Discussed are the availability and characteristics of the biomass resource base in the present and future, and the process used to select the set of four biomass systems studied. This report is one of six documents supporting the technology assessment report. An external evaluation of this report was conducted by the Division of Policy Research and Analysis of the National Science Foundation and is appended to the main volume of this series.

38598 **(PB—83-177618) Energy from biomass: the implications of methanol from silvicultural farms.** Newman, L.C.; Johnson, R.C. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1980. 74p. NTIS, PC A04/MF A01.

Examined is the conversion of wood from a silvicultural energy farm into methanol for use as a transportation fuel. Specific impacts and issues of silvicultural farming are Separated, as far as possible, from impacts and issues associated with the production and use of methanol. The report presents (1) characteristics of producing methanol from wood; (2) the commercialization outlook based on the overall energy context of the United States; (3) a description of priMary stakeholders, such as methanol manufacturers and land managers; (4) a description of secondary stakeholders such as the United States Department of Agriculture and Environmental Protection Agency; (5) implications of a methanol program, such as placing a methanol facility in the community and impacts on the automotive industry; and (6) an analysis of policy options--approaches to encouraging or discouraging the commercialization of methanol fuel from biomass. An external evaluation of this report was conducted by the Division of Policy Research and Analysis of the National Science Foundation and is appended to the main volume of this series.

38599 **(PNL-SA—10604) Methanol production by catalytic gasification of wood.** Brown, M.D.; Mitchell, D.H.; Mudge, L.K.; Robertus, R.J.; Baker, E.G. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1982. Contract AC06-76RL01830. 7p. (CONF-830108—6). NTIS, PC A02/MF A01. Order Number DE83013744.

From 6. ASME energy sources technology conference and exhibition; Houston, TX, USA (30 Jan 1983).

The Pacific Northwest Laboratory, through funding by the US DOE, has developed a process to produce methanol from wood or other types of biomass by gasification with steam in the presence of a catalyst. The methanol yield from this process is greater than processes using fixed gasification of wood. The gasification process has been successfully demonstrated in a 25 kg/hr (50 lb/hr) plant. Operating costs and capital expenditures for plants producing between 180 and 1800 MT (100 and 1000 short tons) of methanol per day have been determined. In the gasification process, dry biomass in the form of chips or fines is augered into a heated bed of catalyst particles which are fluidized by steam at 700 to 750°C. The wood pyrolyzes, producing gases, condensible organic compounds and char. Char is gasified by steam, producing additional hydrogen and carbon monoxide. Condensible organic molecules are cracked by the catalyst, producing more gas. Essentially all organic compounds other than methane are destroyed. The energy for the reaction is provided by heat exchangers in the gasifier. This processing scheme requires no air separation plant and only minimal water treatment facilities. Thus the economics appear promising for plants sized for typical wood resources. In 1982 the demonstration plant was upgraded for operation at 150 psia. The most recent data from pressure operation of the plant will be presented. The economics of the process were thoroughly studied in 1980. These cost estimates will be updated to 1982 and they will incorporate any changes in energy requirements and product yields as demonstrated in the gasifier tests at 150 psia. The effect of the plant size versus methanol cost will also be discussed. 2 figures, 2 tables.

### 0904 Solid Waste And Wood Fuels

*REFER ALSO TO CITATION(S) 38597, 39342*

38600 **(CSS/CI—83-16) Analysis of products from single particle combustion of wood.** Simmons, W.W.; Ragland, K.W. (Wisconsin Univ., Madison (USA). Dept. of Mechanical Engineering). 1983. 23p. (CONF-830358—21). University of Wisconsin, Dept. of Mechanical Engineering, Madison, WI 53706.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

This present work examines the combustion product analysis of wood under conditions similar to those experienced in stoker-type or suspension furnaces. Single particle tests are conducted on sugar pine and red oak under a variety of size, temperature, gas velocity, moisture, and oxygen conditions. Results from the combustion product analysis indicate that for wood cubes with a characteristic length of 10 and 20 cm, the phenomena of initial heating, drying, devolatilization and char combustion do not occur in distinctly separate stages but rather overlap one another. At one point in the burn, char combustion may be occurring in the outer portions of the particle while devolatilization and even drying are occurring internally. These results also indicate that free stream temperature and Reynolds number affect volatile and total burn times. The influence of Reynolds number is not as strong as one would expect based on a purely convective heat transfer effect indicating heating from the flame probably dominates heat transfer during devolatilization. The 20 mm particles, due to lower heating rates per unit mass, generate more char than the 10 mm particles. This causes longer total burn times per unit mass. Increasing particle moisture content increases both volatile and total burn times in a roughly linear manner. Finally, variations in wood type can have a pronounced affect on volatile and total burn times.

38601 **(CSS/CI—83-17) Study of fluidised-bed combustion of wood-waste materials.** Gulyurtlu, I.; Cabrita, I. (Universidade do Porto (Portugal). Dept. of Mechanical Engineering). 1983. 12p. (CONF-830358—15). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83902033.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

A fluidized-bed combustor is currently in use to study combustion of wood-waste materials in the temperature range 600 to 950°C. The eventual aim of this work is to determine whether wood waste could be a feasible substitute to petroleum fuels in wherever possible since such wastes are pretty abundant in Portugal. The fluidized-bed reactor is 20 cm.in diameter. The bed height is about 50 cm. and the total height of the combustor is 2.5 m. The bed is water cooled. The inert bed material is quartz sand. The temperature within the combustor is monitored at various heights, and gas will be drawn out of the reactor at several points to determine the combustion quality. The air is fed to the combustor through a wind box and a distribution plate. The transport of solid particles is carried out pneumatically and the particles are fed to just above the distributor plate. The air velocity is kept just above the minimum fluidization velocity in order to minimize elutriation of wood particles. Work has so far demonstrated that self-sustained combustion of wood waste in a fluidized bed is possible. The main problem with the combustion of wood particles is elutriation. Under very strict experimental conditions, in particular with regard to air velocities elutriation is minimized. The particles that escape the combustor are captured in a cyclone and are then recycled back to the bed.

38602 **(PB—83-177600) Energy from biomass: the implications of industrial use of wood.** Jones, M.; Jones, R.; Bliss, C. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1980. 65p. NTIS, PC A04/MF A01.

The use of wood by industry to generate heat and electricity is examined; and potential issues arising from the widespread use of these technologies are identified and discussed. The report presents (1) an overview of the technology and the market--industrial steam generation, the role of cogeneration, and potential effects of increased use of fuelwood to replace petroleum fuels or natural gas; (2) the institutional setting, involving present and potential industrial users, suppliers, government and other users, and a discussion of specific barriers to further commercialization; (3) economic and environmental impacts including air and water pollution, and solid wastes; and (4) public policy options to monitor future growth of industrial wood combustion applications and prevent or minimize potential adverse impacts. An external evaluation of this report was conducted by the Division of Policy Research and Analysis of the National Science Foundation and is appended to the main volume of this series.

38603 **(PB—83-177626) Energy from biomass: the implications of residential heating with wood.** Newman, L.C.; Jones, M. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1980. 70p. NTIS, PC A04/MF A01.

The use of wood for residential heating is examined and potential issues arising from the increasingly widespread use of wood fuel are identified and discussed. The report presents (1) an overview of the technology and the Market, including comparative costs; (2) the institutional setting, involving potential users, systems providers, and government, and barriers to communication; (3) economic, environmental, legal, social and political impacts; (4) public policy options, including objectives, basic strategy, limitations, market place incentives; and (5) a twenty-year projection of residential wood energy utilization. Also residential use beyond the year 2000 is forecast.

## 13 HYDRO ENERGY

*REFER ALSO TO CITATION(S) 38872*

### 1301 Resources And Availability

*REFER ALSO TO CITATION(S) 38606*

### 1303 Plant Design And Operation

38604 **(DOE/RA/01699—4) City of Idaho Falls Hydroelectric Demonstration Project: final technical and construction cost report. Small-Scale Hydroelectric Power Demonstration Project.** (International Engineering Co., Inc., San Francisco, CA (USA)). May 1983. Contract FC07-78RA01699. 294p. NTIS, PC A13/MF A01. Order Number DE83013853.

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The construction of the Idaho Falls Low-Head Hydroelectric Demonstration Project is summarized. The demonstration project consists of the redevelopment of three existing power plants using bulb turbines and generators. The following are discussed: procurement contracts; preparation of upper plant site; general construction; installation of turbines and generators, mechanical equipment, and electrical equipment; and engineering and construction management. Included in appendices are cost, general construction cost, concrete cylinders test results, and engineering drawings. (MHR)

38605 **(DOE/RA/23215—3) Turlock Irrigation District Drop No. 1 Power Plant: Final operation and maintenance report. Small-scale hydroelectric-power demonstration project.** (Turlock Irrigation District, CA (USA)). Apr 1983. Contract FC07-79RA23215. 24p. NTIS, PC A02/MF A01. Order Number DE83013342.

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Construction of the Turlock Lake Power Plant began in March of 1979. The plant went on-line with all three generators on July 11, 1980. Because the plant was built on the District's irrigation canal system, it is only in operation during the District's irrigation season, which runs from about March 15 through October 15 each year. The operation and maintenance activities, costs, and revenues for the first 2-1/2 years of plant operation are summarized.

### 1305 Economics And Management

*REFER ALSO TO CITATION(S) 38875*

### 1306 Environmental Aspects

*REFER ALSO TO CITATION(S) 39389*

38606 **An approach to optimizing reservoir operation for downstream aquatic resources.** Sale, M.J. (Oak Ridge National Lab., TN); Brill, E.D. Jr.; Herricks, E.E. *Water Resources Research;* 18: No. 4, 705-712(Aug 1982). Contract W-7405-ENG-26.

The issue of instream flow maintenance for downstream aquatic resources is a relatively new environmental quality consideration required in planning water resources projects. A mathematical programing methodology is proposed to examine the relationship between biological instream flow needs (IFN) and more traditional water project objectives, such as water yield, flood control, reservoir recreation, or economic efficiency. This optimization approach combines the linear decision rule (LDR) modeling technique with an objective function representing the value of reservoir releases to downstream fisheries. The IFN performance objective is based on an index of physical habitat conditions called weighted usable area (WUA) which has been developed by the U.S. Fish and Wildlife Service. Data from a multipurpose reservoir in central Illinois have been used to demonstrate the application of the nonlinear programing model and a heuristic solution algorithm employing piecewise linearization of the habitat objective functions and linear programing.

## 14 SOLAR ENERGY

38607 **(DOE/CS/89004—T1) Federal Solar Programs Summary Document.** Spotswood, B.D.; Schumacher, S.B. (Solar America, Inc., Washington, DC). Apr 1981. Contract AC01-80CS89004. 183p. NTIS, PC A09/MF A01. Order Number DE83013333.

This Solar Program Summary Document represents an effort to identify major solar initiatives throughout specified agencies of the Federal government. The agencies included in this document are members of the Permanent Standing Solar Subcommittee of the Energy Coordinating Committee. It is recognized that other agencies may have solar projects, but under the guidelines for this document have not been included. This document identifies the existing solar programs of FY 80 and reviews their status. The technologies included are: photovoltaic energy systems; wind energy systems; biomass energy systems; ocean energy systems; solar thermal energy systems; passive solar; and active solar. Activities in these areas cover a wide range. They include: research and development; information dissemination; demonstration projects; financial incentives; and training and technical assistance.

### 1403 Economics

*REFER ALSO TO CITATION(S) 38700, 38736, 38738*

38608 **(DOE/EIA—0174(82)) Solar collector manufacturing activity, 1982.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). May 1983. 68p. NTIS, PC A04/MF A01. Order Number DE83013840.

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This report presents production, sales, and end-use data from manufacturers of solar thermal collectors and photovoltaic modules.

38609 **(DOE/PE/70047—T2) Parametric analysis of investment tax-credit programs for solar industrial-process-heat equipment. Final report.** (Technology and Economics, Inc., Cambridge, MA (USA)). [nd]. Contract AC01-79PE70047. 122p. NTIS, PC A06/MF A01. Order Number DE83013339.

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The results of a parametric analysis of investment tax credits for solar industrial process heat systems are presented. An investment decision model was used to determine when firms could be expected to invest in solar IPH systems based on given assumptions and an investment tax credit ranging from 30% to 60%. The impacts of the different tax credit levels were then aggregated over industries and solar regions. A 30% tax credit was found to be insufficient to yield significant conversion from conventional to solar IPH. At least 40% was found necessary to make solar competitive with oil in most solar regions, and 50% to make solar competitive with gas. (LEW)

38610 **(DOE/PE/70047—T5) Market development potential for photovoltaics: a review of recent research.** Dernburg, J.; DePaso, D.; Fenton, C. (Technology and Economics, Inc., Cambridge, MA (USA)). Mar 1981. Contract AC01-79PE70047. 169p. NTIS, PC A08/MF A01. Order Number DE83013877.

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Ten recent studies of the market development potential for photovoltaic electricity generation are reviewed. The studies examine the assumed conditions and trends under which market development will occur, the present barriers to penetration, and the role of photovoltaics in the US energy outlook. Each study is examined in terms of the methodology employed, the assumptions made, and the conclusions reached. The predicted market development scenarios are compared with the Federal Long-Range Photovoltaic Plant targets. (LEW)

38611 **(EPRI-EM—3092-SY) Utility-impacts assessment of residential passive-solar systems. Final report.** Wood, R.A.; Siegel, M.D. (JBF Scientific Corp., Wilmington, MA (USA)). Mar 1983. 43p. NTIS, PC A03/MF A01. Order Number DE83902642.

This report summarizes a project undertaken to provide the electric-utility industry with a tool to use in analyzing the advantages and disadvantages for themselves and their customers of passive-solar residential construction within their service areas. A methodology to accomplish this was created and then tested in cooperation with seven participating utilities. Results indicate that passive solar homes and well-insulated homes are more economic to both utilities and homeowners than conventional homes insulated to ASHRAE 90-75 standards, still the norm for building construction in many parts of the country. Further indications are that passive-solar homes may have lower life-cycle costs for heating and cooling than well-insulated homes in areas of the country where the

annual heating load predominates over the annual cooling load, and where there is an adequate amount of sunshine during the heating season. The methodology developed also has the capability of simulating and comparing the performance of a wide variety of non-solar electrical heating and cooling systems. As a result, it can be adapted by utilities for a broad range of residential energy analyses.

38612 **(GAO/RCED—83-8) Business Energy Investment Credit for solar and wind energy.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 7 Mar 1983. 54p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

The Business Energy Investment Credit, which provides a 15% tax credit to owners of new solar and wind energy equipment, is scheduled to expire on December 31, 1985. This reports presents: (1) GAO's analysis of the credit's effect on the economics of four projects which were to employ solar and wind energy systems; (2) a summary of the views of a broad spectrum of organizations on the desirability of extending the credit past its currently scheduled expiration date; and (3) a discussion of the possible revenue loss to the Treasury resulting from an extension.

38613 **Minimum cost of photovoltaic energy for a utility grid and general features of a generating plant using costless solar cells.** Madet, D. (Ingenieur a la Direction des Exudeset Recherches, Elecricite de France). pp 307-311 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The purpose of this work is to evaluate the minimum long term cost of electricity produced by future photovoltaic plants connected to a utility grid. As the cost of photovoltaic cells is supposed to drop dramatically, our basic assumption is that, in the long run, it will be near zero. Our approach consisted in imagining a very simple kind of photovoltaic plant based on this assumption, then in estimating the lowest value of the total cost per peak kW of the plant and finally the lowest cost of generated electricity. A computer program has been worked out to optimize the various electrical, physical and economic characteristics of the plant. According to various assumptions concerning the cell life time under such conditions, their efficiency and the improvement of inverters, the capital cost of each peak kW was found to range from 2200 FF to 5600 FF. Therefore the hypothetical and ultimate kWh price would vary from 0,15 FF to 0,40 FF for the weather conditions typical of the South of France, and a little bit more than half those values in very sunny countries.

## 1404 Environmental, Legal, And Institutional Aspects

*REFER ALSO TO CITATION(S) 38771, 39389*

38614 **(SERI/TR—733-741) Solar energy legal bibliography update.** Seeley, D. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1980. Contract AC02-77CH00178. 103p. NTIS, PC A06/MF A01. Order Number DE83014403.

The Solar Energy Legal Bibliography Update is a compilation of approximately 100 solar publications abstracted for their legal and policy content (covering the period October 1978 to August 1979). Emphasis is on legal barriers and incentives to solar energy development. Abstracts are arranged under the following categories: Antitrust, Biomass, Building Codes, Consumer Protection, Environmental Aspects, Federal Legislation and Programs, Financing/Insurance, International Law, Labor, Land Use (Covenants, Easements, Nuisance, Zoning), Local Legislation and Programs, Ocean Energy, Patents and Licenses, Photovoltaics, Solar Access Rights, Solar Heating and Cooling, Solar Thermal Power Systems, Standards, State Legislation and Programs, Tax Law, Tort Liability, Utilities, Warranties, Wind Resources, and General Solar Law.

## 1405 Solar Energy Conversion

*REFER ALSO TO CITATION(S) 38579, 38580, 38581, 38583, 38589, 38591, 38593, 38594, 38595, 38596, 38597, 38598, 38599, 38600, 38601, 38602, 38608, 38717, 38730, 38741, 39062, 39143, 39162, 39163, 39164, 39165, 39169, 39176, 39177, 39193, 39196, 39197, 39198, 39199, 39200, 39201, 39202, 39203, 39204, 39205, 39208, 39210, 39211, 39215, 39342, 39389, 39397, 39449*

38615 **(CONF-830114—7) Energy from biomass and wastes: 1982 update.** Klass, D.L. (Institute of Gas Technology, Chicago, IL (USA)). 1983. 66p. Inst. of Gas Tech., Chicago, IL 60616.

From Energy from biomass and wastes symposium; Lake Buena Vista, FL, USA (24 Jan 1983).

Although federal support of research to develop energy from biomass and wastes continued to decrease in 1982, other sources of funding are taking up some of the slack. The contribution of energy from biomass and wastes to US primary energy consumption has increased to about 2.7 quads or 3.5% of total consumption and is projected to grow to about 3.5 quads by 1985. A reassessment of future climatic changes because of the greenhouse effect has not found any new results that require revision of the first assessment conducted in 1979. It is therefore apropos to begin to incorporate methodologies into world energy and biomass management that take this effect into account before any adverse changes begin to occur. Extensive research programs have continued on biomass production for energy applications and on the gasification and liquefaction of biomass and wastes for fuels, energy, and chemicals. Commercialization of this technology appears to be increasing at a higher rate, particularly for combustion of wood, wood wastes, and municipal solid wastes for heat, steam, and electric production; anaerobic digestion of industrial wastes for combined waste disposal and methane production; and use of fermentation ethanol as a motor fuel. Ethanol-fuel usage more than doubled in 1982 in the United States as compared to 1981, and plant capacity is expanding rapidly. Methanol has not yet begun to compete with ethanol because of federal limitations on the concentration of methanol in blends with gasoline. Relaxation of these requirements and passage of tax-forgiveness laws for methanol now enjoyed by ethanol could provide the incentives to make methanol the dominant fuel for vehicles in the long term.

38616 **(CONF-830114—8) Biogasification of woody biomass following physical and chemical pretreatment.** Jerger, D.E.; Dolenc, D.A.; Chynoweth, D.P. (Institute of Gas Technology, Chicago, IL (USA); Gas Research Inst., Chicago, IL (USA)). 1983. 14p. Inst. of Gas Tech., Chicago, IL 60616.

From Energy from biomass and wastes symposium; Lake Buena Vista, FL, USA (24 Jan 1983).

Recent studies have shown high bioconversion efficiencies without pretreatment from woody biomass. Methane yields of approximately 0.3 std $m^3/kg^*$ (55% organic conversion efficiencies) have been achieved from select woody substrates (hybrid poplar and sycamore) at long solids residence times, indicating that anaerobic digestion may be a technically feasible process for the production of methane from wood. Physical and chemical pretreatment processes were examined for their ability to further improve wood biodegradability toward developing an effective biomass-conversion process. Physical treatment consisted of mechanical size reduction of hybrid poplar feed using an Urschell mill and a wet-extrusion milling technique resulting in particle sizes ranging from 0.003 to 8 mm. Methane yields did not differ significantly over the particle-size range tested; however, an increase in the methane production rate was observed as the particle size decreased. Chemical treatment consisted of treating cottonwood, hybrid poplar, and sycamore with 5% and 50% sodium hydroxide per gram feed volatile solids in closed containers for 2-1/2 hours at 100°C. Following pretreatment, batch bioassays were performed to evaluate the effectiveness of the treatments on the methane yields and production rates from these feeds. Sodium hydroxide pretreatment resulted in a significant increase in the methane yield from cottonwood (approximately 32 to 43%), with smaller increases observed from hybrid poplar and sycamore (5 to 10%). Increased methane production rates, however, resulted for all three species, because only 12 to 14

days were necessary to achieve similar bioconversion efficiencies requiring up to 60 days solids retention times without treatment.

38617 (DOE/CS/40071—24) **Direct enzymatic extraction of starch from corn as an energy saving alternative to production of high fructose syrup. Final executive report.** (Purdue Univ., Lafayette, IN (USA). Lab. of Renewable Resources Engineering). Dec 1982. Contract AC02-78CS40071. 545p. NTIS, PC A23/MF A01. Order Number DE83011048.

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The purpose of this project was to study, test, and demonstrate a process of producing high-fructose corn syrup and protein byproducts from dry milled corn as an energy conserving alternative of the current industrial corn wet-milling process. This final report is divided into 5 sections. Section 1 deals with the process which is the main and, indeed, the final product of the energy conservation study. Section 2 deals with protein Extraction which conditions the dry-milled corn before hydrolysis. Section 3 deals with the analytical technique of GPC developed with the alpha-amylase hydrolysis of starch. Section 4 deals with immobilized glucoamylase hydrolysis. Section 5 deals with the recovery of soluble protein by ion-exchange resins. Each section has been abstracted separately for inclusion in the Energy Data Base. (DMC)

38618 (DOE/CS/40071—24, pp 1-137) **Protein separation from corn endosperm by solvent extraction.** Russell, M.H. (Purdue Univ., Lafayette, IN). Dec 1982. NTIS, PC A23/MF A01.

In Direct enzymatic extraction of starch from corn as an energy saving alternative to production of high fructose syrup. Final executive report.

The two major classes of corn endosperm protein, zein and glutelin, were extracted by using the solvents ethanol and sodium hydroxide. For each class, the primary phenomena responsible for the rate of protein dissolution and extraction were quantitatively evaluated and modeled. Maximal extractions of zein from corn endosperm were obtained by using 55% to 65% (w/w) ethanol and solvent:endosperm ratios of 20 ml:l $cm^3$ or greater, allowing recovery of 97% of the total zein. The apparent rate of zein solubilization, determined with 100 micron endosperm particles, was best described as a first order reaction. The apparent activation energy was 3.9 kcal/mole suggesting that pore diffusion may have influenced the observed rates. The extraction of zein from larger endosperm particles appeared to be controlled by pore diffusion with the calculated value of De King $3.7 \times 10^{-10}$ $cm^3/s$ (average). The initial rate of glutelin solubilization varied linearly with $N_5OH$ concentration and was found to have an activation energy of 6.2 kcal/mole, again indicating probable diffusional influence on the measured kinetics. The overall rate of glutelin solutilization was modeled with reaction-rate-limited shrinking core kinetics by assuming that the rate of glutelin solubilization was proportional to the rate of disulfide bond cleavage. Two-step sequential extractions of zein and glutelin were found to result in overall solubilization of approximately 90% of the total protein in corn endosperm. In large scale extractions, it appears to be sufficient to use only enough ethanol to wet the endosperm before adding sodium hydroxide to solubilize the remaining portion. This method should result in 80% to 85% protein recoveries for pilot plant scale operations.

38619 (DOE/CS/40071—24, pp 138-227) **Adsorption of proteins on activated carbon and phenolic resin.** Wu, R.A. (Purdue Univ., Lafayette, IN). Dec 1982. NTIS, PC A23/MF A01.

In Direct enzymatic extraction of starch from corn as an energy saving alternative to production of high fructose syrup. Final executive report.

Adsorption of BSA lysozyme and mixture of the two proteins from aqueous solution onto activated carbon and adsorption of BSA onto phenolic resin has been studied to develop design parameters for protein adsorption and to evaluate the effective diffusivity of the proteins. The findings then are used as the theoretical basis for the study of processes such as enzyme immobilization and removal of proteinaceous materials from corn syrup. The effects of pH, buffer concentration and temperature are investigated for each adsorption process. The adsorption of proteins onto both adsorbents was found to be irreversible in nature through desorption study and isotherm development. The adsorption maximum is near the isoelectric point of protein regardless of the type of adsorbent used. The carbon seemed to have the same adsorption capacity for BSA and lysozyme; being 26 mg/g carbon and 27 mg/g carbon, respectively. The correspondent occupied surface area is 10.4 $m^2/g$ carbon for BSA and 13.2 $m^2/g$ carbon for lysozyme. More protein was adsorbed on phenolic resin; the adsorption capacity was 3t mg/g resin.The calculated capacity of resin for lactase was 1.8 g/g and the capacity of carbon for corn syrup protein is 4.6 mg/g assuming that surface coverage is the same as the model protein. The rate of protein adsorption onto porous material was found to be controlled by the pore diffusion process and the effective diffusion coefficient was evaluated with the shrinking core model. In general, there is little difference between the effective diffusion coefficients calcualted using infinite-bath approach and finite-bath approach. The knowledge of the pure protein adsorption was combined with the molecular weight of interested proteins to successfully predict the adsorption capacity of adsorbent and the effective diffusivity of the proteins in the adsorbent for lactase immobilization and corn syrup removal.

38620 (DOE/CS/40071—24, pp 228-402) **Development of aqueous size exclusion chromatography for the study of substrate structure and susceptibility in enzymatic starch hydrolysis.** Rollings, J.E. (Purdue Univ., Lafayette, IN). Dec 1982. NTIS, PC A23/MF A01.

In Direct enzymatic extraction of starch from corn as an energy saving alternative to production of high fructose syrup. Final executive report.

A physical model of starch structure during hydrolysis is presented. The model states that various crystalline states of the constituent starch molecules are present throughout the course of degradation. An appropriate means of determining the macromolecular size and molecular size distribution of starch during hydrolysis, aqueous size exclusion chromatography, is developed. The method employs a strong alkaline mobile phase and porous gel chromatographic supports which are stable to the basic solutions. The separation range of molecular sizes can be extended by coupling size exclusion chromatographic columns in a manner that will maintain linearity in molecular size separation with elution volume. Although separation efficiency is mass transfer limited, efficiency of separation can be increased by controlling eluent flow rate and gel particle packing size and packing size distribution. Monitoring enzymatic starch depolymerization by aqueous size exclusion chromatography shows that molecular size distribution, reaction extent and reaction rate strongly depends upon the crystalling state of the substrate and the activity of the enzyme.The susceptibility of starch to hydrolysis by $\alpha$-amylase is closely related to the crystalline states of the substrate. Starch crystals are present both in the natural granule structure and in retrograded starch; retrogradation lowers reaction extent. Due to thermal deactivation, the highest overall conversion achieved for a given amount of enzyme is obtained at temperatures below the upper limits of the gelatinization range of starch. The initial rate of the reaction is greatest at temperatures above the gelatinization range. The rate and extent of depolymerization is increased by increasing the enzyme concentration within the reactor or by the addition of certain stabilizing agents.

38621 (DOE/CS/40071—24, pp 403-526) **Study of immobilized enzyme reactor.** Chen, Y.E. (Purdue Univ., Lafayette, IN). Dec 1982. NTIS, PC A23/MF A01.

In Direct enzymatic extraction of starch from corn as an energy saving alternative to production of high fructose syrup. Final executive report.

This study deals with the characterization of immobilized glucoamylase on polyvinylchloride (PVC)-silica membranes and the associated problems of reactor design. An industrially feasible process for making high glucose sugar from commercially available, partially hydrolyzed starch by using immobilized glucoamylase on this patented membrane is developed and discussed. This type of PVC-silica mixed membrane has 70% porosity and is characterized by the unique feature that the pores are mostly open channels. Therefore, the immobilized enzyme molecules do not experience pore diffusion limitations since the inner surface area of the membrane is well-exposed. Experimental results indicate that the enzyme glucoamylase, after immobilization on this membrane, can produce a 93 to 97% conversion of starch into glucose, which is

higher than that obtained previously with immobilized glucoamylase. In this work, efforts are made to optimize glucose yield, while keeping all other reaction variables within industrially acceptable limits. This thesis research can be divided into three major areas: (1) immobilization of the enzyme, (2) reactor performance with the heterogeneous polymerization reaction, and (3) reactor design.

38622 (DOE/CS/40071—24, pp 527-531) **Alternative technology for corn milling and high fructose corn syrup production.** Russell, M.H.; Tsao, G.T. (Purdue Univ., Lafayette, IN). Dec 1982. NTIS, PC A23/MF A01.

In Direct enzymatic extraction of starch from corn as an energy saving alternative to production of high fructose syrup. Final executive report.

The production of high fructose corn syrup (HFCS) by the process of corn wet milling requires large volumes of water for the steeping and milling operations. The water, incorporated into various process streams, creates extensive requirements for dewatering, drying, and evaporation, resulting in an energy-intensive process. In order to reduce the overall energy requirements of HFCS production, an alternative process has been developed combining initial dry milling of corn with subsequent solvent extraction of protein and conversion of starch to syrup. Based on laboratory studies of the alternative process, the water removal load is less than half of that for wet milling and a full scale plant using the alternative technology should require 30% less energy than a corresponding wet milling facility. Further development work is in progress on a pilot plant scale to allow process optimization and to afford more accurate evaluation of the energy requirements of the proposed process.

38623 (DOE/ET/20460—3) **Amorphous-silicon thin-film heterojunction solar cells. Third quarterly progress report, April 1-June 30, 1979.** (Mobil Tyco Solar Energy Corp., Waltham, MA (USA)). 1 Aug 1979. Contract AC03-78ET20460. 30p. NTIS, PC A03/MF A01. Order Number DE83013418.

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Reported here are additional results of the experiments of the substitution of C for Si and initial results on the substitution of Ge for Si in hydrogenated a-Si films grown by capacitive glow-discharge techniques. Results for the Group IV matrix substitutions are qualitatively consistent with the published data for the hydrogenated a-Si/sub x/C/sub 1-x/ and the a-Si/sub x/Ge/sub 1-x/ systems. The electrical properties of the various films measured thus far are summarized.

38624 (DOE/JPL—1012-86) **Handbook of photothermal test data on encapsulant materials.** Liang, R.H.; Oda, K.L.; Chung, S.Y.; Smith, M.V.; Gupta, A. (Jet Propulsion Lab., Pasadena, CA (USA)). 1 May 1983. Contract AI01-76ET20356. 159p. (JPL-PUB—83-32). NTIS, PC A08/MF A01. Order Number DE83013950.

This report describes laboratory tests performed to characterize candidate encapsulation materials with respect to changes in their physical and chemical properties caused by photothermal aging. Several key material properties relating directly to material degradation and deterioration of performance have been identified and have been monitored as functions of aging conditions and time. This handbook provides a status report on accelerated testing activities and presents experimental data collected before and during December 1982. The use of these data in development and dissemination of predictive models describing the rate of aging as a function of stress parameters is a separate and ongoing task.

38625 (DOE/JPL/956046—83/5) **EBIC investigation of hydrogenation of crystal defects in EFG solar silicon ribbons. Quarterly report, January 1-March 31, 1983.** Sullivan, T.; Ast, D.G. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering). May 1983. Contract NAS-7-100-956046. 98p. NTIS, PC A05/MF A01. Order Number DE83013881.

Changes in the contrast and resolution of defect structures in 205 Ohm-cm EFG polysilicon ribbon subjected to annealing and hydrogenation treatments were observed in a JEOL 733 Superprobe scanning electron microscope, using electron-beam-induced current (EBIC) collected at an Al Schottky barrier. The Schottky barrier was formed by evaporation of Al onto the cleaned and polished surface of the ribbon material. Measurement of beam energy, beam current, and the current induced in the Schottky diode enabled observations to be quantified. Exposure to hydrogen plasma increased charge collection efficiency. However, no simple causal relationship between the hydrogenation and charge collection efficiency could be inferred, because the collection efficiency also displayed an unexpected thermal dependence. Good quality intermediate-magnification (1000X-5400X) EBIC micrographs of several specific defect structures were obtained. Comparison of grown-in and stress-induced dislocations after annealing in vacuum at 500°C revealed that stress-induced dislocations are hydrogenated to a much greater degree than grown-in dislocations. The theoretical approximations used to predict EBIC contrast and resolution may not be entirely adequate to describe them under high beam energy and low beam currrent conditions.

38626 (DSE—4042-T4) **Development of electrochemical photovoltaic cells. First technical progress report, April 15-July 31, 1979.** Austin, A.E.; Byker, H.J.; Brooman, E.W. (Battelle Columbus Labs., OH (USA)). 17 Aug 1979. Contract AC02-77CH00178. 11p. NTIS, PC A02/MF A01. Order Number DE83013448.

The development of stable, efficient, photoelectrochemical cells based on silicon and gallium arsenide electrodes in contact with nonaqueous electrolyte systems is being investigated. During this first reporting period electrode materials selection, acquisition, and cell fabrication were concluded. The necessary experimental apparatus was assembled, and materials were selected, ordered, and acquired. At the end of this reporting period the program costs and man-hours are close to the estimated projections. To date no technical or contractual problems have been encountered.

38627 (EGG-ELS—6177) **1982 silvicultural research and biomass production using saline waters.** Breckenridge, R.P.; Wheeler, L.R.; Thurow, T.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1983. Contract AC07-76ID01570. 32p. NTIS, PC A03/MF A01. Order Number DE83013784.

The objective of this research was to determine the biomass production potential of tree species planted on land of marginal agricultural value and irrigated with saline water. By determining which tree species are tolerant of such conditions while still offering high biomass production potential, a crop could be grown with resources not suitable for agricultural crop production. This type of research is important because tree biomass is a renewable resource that produces a product, cellulose, which can be converted to petroleum substitutes for use as eneryg or as a feedstock from which many organic chemicals can be obtained. Data from this research will identify salt tolerant tree species and determine their production potential. These data will be a key factor in determining the technical and economic feasibility of such a program. Data collected after the first year of field tests indicate that several species offer high potential for biomass production. Boxelder, russian olive, hybrid poplars and sumac, with first year biomass increases ranging from 272 to 409%, were the most promising of the 16 species tested. These dramtic increases suggest a great biomass production potential for these species. 9 tables.

38628 (N—8314671) **Low cost solar array project cell and module formation research area: Process research of non-CZ silicon material.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). 1981. 33p. (NASA-CR—169632). NTIS, PC A03/MF A01.

Liquid diffusion masks and liquid applied dopants to replace the CVD Silox masking and gaseous diffusion operations specified for forming junctions in the Westinghouse baseline process sequence for producing solar cells from dendritic web silicon were investigated. The baseline diffusion masking and drive processes were compared with those involving direct liquid applications to the dendritic web silicon strips. Attempts were made to control the number of variables by subjecting dendritic web strips cut from a single web crystal to both types of operations. Data generated reinforced earlier conclusions that efficiency levels at least as high as those achieved with the baseline back junction formation process

can be achieved using liquid diffusion masks and liquid dopants. The deliveries of dendritic web sheet material and solar cells specified by the current contract were made as scheduled.

**38629 (N—8314687) Solar cell radiation handbook.** Tada, H.Y.; Carter, J.R. Jr.; Anspaugh, B.E. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1982. 403p. (NASA-CR—169662; JPL-PUB—82-69). NTIS, PC A18/MF A01.

The handbook to predict the degradation of solar cell electrical performance in any given space radiation environment is presented. Solar cell theory, cell manufacturing and how they are modeled mathematically are described. The interaction of energetic charged particles radiation with solar cells is discussed and the concept of 1 MeV equivalent electron fluence is introduced. The space radiation environment is described and methods of calculating equivalent fluences for the space environment are developed. A computer program was written to perform the equivalent fluence calculations and a FORTRAN listing of the program is included. Data detailing the degradation of solar cell electrical parameters as a function of 1 MeV electron fluence are presented.

**38630 (N—8314698) Module technique of 5 x 5 cm(2) solar cells.** Koch, J. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Wedel (Germany, F.R.)). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 17-21 (SEE N83-14694).

Investigations of cover glass bonding, contact welding, interconnection design and solar cell laydown to substrates are summarized. The module technique for 5 x 5 cm cells is characterized by 100 micron thick space qualified cover glasses (microsheet and fused silica) and interconnectors with stress reliefs in an out of plane and an inplane configuration. Thermal cycle tests prove the applicability of 5 x 5 cm cell module techniques on solar arrays.

**38631 (N—8314699) Large area low-cost space solar cell development.** Barona, C.R.; Cioni, J.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1982. 4p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 23-26 (SEE N83-14694).

A development program to produce 5.9 x 5.9 cm space quality silicon solar cells with a cost goal of 30 $/W is described. Cell types investigated include wraparound dielectric, mechanical wraparound and conventional contact configurations with combinations of 2 or 10 ohm/cm resistivity, back surface reflectors and/or fields, and diffused or ion implanted junctions. A single step process to cut cell and cover glass simultaneously is being developed. Results for cell and array tests are given. Large solar arrays that might use cells of this type are discussed.

**38632 (N—8314700) Nonlinear algorithms application to irradiated solar cell parameters evaluation.** Cabestany, J.; Castaner, L. (ETSI Telecomunicacion, Barcelona (Spain)). Jun 1982. 7p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 27-33 (SEE N83-14694).

A method which calculates the parameters of solar cell equivalent circuits is presented. The method is based on the definition of an object function of the difference between the experimental I(V) curve and the model. The object function is found to be nonlinear, so algorithms have to be used to find a solution that optimizes this function. Least mean square and minimax both give good results. A method to find an initial solution, critical in the time calculations of the routine, is also described. The parameters of proton irradiated solar cells were calculated.

**38633 (N—8314701) Lift off: A very fine front metallization geometry technique for high efficiency solar cells.** Nijs, J.; Dhoore, F.; Mertens, R.; Vanoverstraeten, R. (Katholieke Universiteit te Leuven (Belgium)). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 37-42 (SEE N83-14694).

A lift off technique for TiPdAg metallization is described. A photoresist pattern is used before evaporation of the metal. After the metal is evaporated, the photoresist is removed, lifting off the metal on top of it. Where the photoresist was already removed before metallization with developing, the metal remains on the wafer. There must be a discontinuity in the metal due to the photoresist pattern, so that the dissolvant can reach the resist itself or the steps in the photoresist pattern may only be covered with a very thin layer of metal when the technique is used in an ultrasonic medium. Fingers of 10 microns width and 3 microns thickness are obtained, resulting in an optimized trade-off between metal coverage and series resistance. Silicon solar cells with AM1 efficiencies 17% are obtained.

**38634 (N—8314702) Thin cell development and testing.** Fodor, J.; Neal, N. (Spectrolab, Inc., Sylmar, CA (USA)). Jun 1982. 8p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 43-50 (SEE N83-14694).

Over 200 silicon cells, 62 microns thick, with average AMO efficiencies of 13.5% were used in the fabrication of 10 lightweight modules featuring flexible substrates, welded interconnects, and thin coverslides ( 100 microns). The ability of these five cells in series by three cells in parallel modules to survive the space environment was proven by subjecting modules to acoustic and thermal cycle testing typical of planned geosynchronous missions.

**38635 (N—8314703) Family of thin high efficiency silicon solar cells.** Rasch, K.D.; Roy, K.; Tentscher, K.H.; Gringel, D. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Heilbronn (Germany, F.R.)). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 51-56 (SEE N83-14694).

Ultrathin (50 micron) and thin (100 and 150 micron) silicon solar cells were produced. The matrix contains cells with back surface reflector (BSR) and back surface field (BSF). The beginning of life (BOL) electrical output and the cell performance after electron irradiation up to 1 MeV and post photon irradiation testing as a function of thickness and base material (1 ohm-cm float zone and 10 ohm-cm crucible grown (CG) boron doped silicon) are presented. The ultrathin BSFR cell is the only cell that shows the advantage of BSF beyond 1MeV. In respect to cost and yield, non-BSF cells with an optimized BSR in the range of 100 to 150 microns are attractive for high fluence level missions. Besides the thermal advantage, the BSR in conjunction with diffused BSF shows benefits after electron radiation due to the photovoltaic effects of BSR. The FZ cells show the lowest EOL power output as a result of photon induced degradation. Nevertheless, these cells can be as attractive as a high EOL open-circuit voltage device, if the problem of photon degradation can be solved.

**38636 (N—8314704) Electrophoreted CdS/$Cu_2S$ solar cells for space applications.** Williams, E.W.; Gibbons, D.J.; Cumberbatch, T.J.; Mcinally, I.D.; Claybourn, M. (Thorn EMI Ltd., Hayes (UK). Central Research Labs.). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 57-61 (SEE N83-14694).

Both CdS and $Cu_2S$ were deposited by a process which uses ammonium sulphide instead of hydrogen sulphide. Cracking is a

problem on films with a thickness above 1.5 microns. In space grain size problems should be eliminated as calculations show that particle sizes 0.5 microns can be used in the colloids compared to 0.02 microns for terrestial colloids. Another problem is oxygen inclusion at the anode due to the lack of buoyancy of the bubbles formed in the water/methanol mixtures. However, high methanol contents reduce bubble concentrations. These photovoltaic junctions could be easily prepared in a long life solar breeder spacecraft. Tests of annealing with a pulsed dye laser indicate that photovoltages of 400mV can be produced from copper dipped CdS films.

**38637 (N—8314705) On the cause of the flat-spot phenomenon observed in silicon solar cells at low temperatures and low intensities.** Weizer, V.G.; Broder, J.D.; Brandhorst, H.W.; Forestieri, A.F. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 65-70 (SEE N83-14694).

A model that explains the flat-spot power loss phenomenon is presented. Evidence suggests that the effect is due to localized metallurgical interactions between the silicon substrate and the contact metallization. These reactions are shown to result in localized regions in which the P-N junction is destroyed and replaced with a metal semiconductor-like interface. The effects of thermal treatment, crystallographic orientation, junction depth, and metallization are shown along with a method of preventing the effect through the suppression of vacancy formation at the free surface of the contact metallization. Data indicating the effectiveness of a TiN diffusion barrier in preventing the effect are also given.

**38638 (N—8314706) Aspects of end of life design for solar cells.** Schilling, R.; Rasch, K.D.; Roy, K. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Heilbronn (Germany, F.R.)). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 71-75 (SEE N83-14694).

The power performances before and after electron irradiation of solar cells with different short wavelength responses and of solar cells with material or process induced low initial power output are represented. From a 10 ohm-cm crucible grown boron doped crystal, high efficiency solar cells with different shallow junctions and with different reflection minima were produced. Standard high efficiency solar cells were obtained from the same crystal with simulated process failure and from a second crystal with low carrier lifetime. Short circuit current and maximum power were measured after fabrication and after 1 MeV electron irradiation of fluences of 2 times 10 to the 14th and 1 times 10 to the 15th power/sqcm. High initial power optimized solar cells change to lower values after electron irradiation in contrast to the cells with lower initial power but high short wavelength response. It is demonstrated that after electron irradiation the power decrease of cells with material or process induced low initial power is smaller compared with reference cells.

**38639 (N—8314707) Optimization of silicon solar cells for solar generators with concentration.** Ebeling, W.D.; Rex, D. (Technische Univ. Braunschweig (Germany, F.R.)). Jun 1982. 9p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 77-85 (SEE N83-14694).

Solar cell optimization by changing the contact grid pattern and the thickness of the n-layer in order to reduce the electrical series resistance, and by changing the thickness of the antireflective coating in order to adjust it to the inclined irradiation are discussed. A mathematical model of silicon solar cells by which the optimal solar cell type can be designed individually for each concentration system is presented. Such optimized solar cells can produce 18% more power than conventional cells in the concentrating system SARA.

**38640 (N—8314708) Effects of processing and dopant on radiation damage removal in silicon solar cells.** Weinberg, I.; Brandhorst, H.W.; Swartz, C.K.; Mehta, S. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 89-93 (SEE N83-14694).

Gallium and boron doped silicon solar cells, processed by ion implantation followed by either laser or furnace anneal were irradiated by 1 MeV electrons and their postirradiation recovery by thermal annealing was determined. During the postirradiation anneal, gallium doped cells prepared by both processes recovered more rapidly and exhibited none of the severe reverse annealing observed for similarly processed 2 ohm-cm boron doped cells. Ion implanted furnace annealed 0.1 ohm-cm boron doped cells exhibited the lowest post-irradiation annealing temperatures after irradiation. The drastically lowered recovery temperature is attributed to the reduced oxygen and carbon content of the 0.1 ohm-cm cells. Analysis based on defect properties and annealing kinetics indicates that further reduction in annealing temperature is attainable with further reduction in the silicon's carbon and/or divacancy content after irradiation.

**38641 (N—8314709) Omnidirectional proton radiation of thin and thick solar cells.** Walkden, M.W. (Royal Aircraft Establishment, Farnborough (UK)). Jun 1982. 8p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 95-102 (SEE N83-14694).

Proton damage ratios, relating the damage caused by 1 MeV electrons to that caused by protons of various energies, were found for hemispherical isotropic proton conditions. The proton fluences were incident on either the front or rear of the cell. Six types of cell ranging in thickness from 50 to 250 microns were used. The ratios are much higher than those derived in earlier studies where normal incidence protons were employed, although the differences are offset by the cell cover glass or rear shield. Results are compared with proton maps AP6 and AP8.

**38642 (N—8314710) The reduction of radiation damage in space solar cells. A study of radiation defects in silicon (+).** Bielle-Daspet, D.; Bourgoin, J.; Bernard, J.; Castaner-Munoz, L.; Pratt, L. (Centre National de la Recherche Scientifique, 31 - Toulouse (France)). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 103-108 (SEE N83-14694).

Research data on space environmental flux and simulation conditions electron and photon induced defects measurement techniques for correlated study of the microscopic macroscopic and global (electrical) degradation of the solar cell and numerical models for space cell and degradation prediction were reviewed. The survey indicates that space factors must include possible contributions of solar flare protons, photon effects and thermal annealing due to the insolation and temperature cycles of the solar generators. An adapted set of measurement techniques must be used in order to obtain comprehensive characterization of defect and solar-cell behavior. In numerical models of solar cell electrical behavior and degradation, cell structure as well as defect and carrier properties must be introduced. In space, P-type silicon should behave better than N-type lithium in N-type gives improvement only in particular cases, and photon degradation seems to be related to boron doping when carbon and oxygen content are simultaneously low.

**38643 (N—8314711) Electron and photon degradation of boron doped FZ silicon solar cells.** Markvart, T.; Cumberbatch, T.J.; Walkden, M.W. (Southampton Univ. (UK)). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 109-114 (SEE N83-14694).

The short circuit current of cells damaged by electron irradiation and post-electron illumination was analyzed. It is shown that the electron damage coefficient of the cells is inversely proportional to the base resistivity, in the range 0.3 to 115 ohm-cm. Photon degradation (characterized by the ratio r identical with K ph/Kel Sigma ph/Sigma el, where K ph and Kel are functions of the base resistivity, and describe the resistivity dependence of photon and electron degradation) displays a more complicated resistivity dependence. This is explained in terms of illumination-induced defect reaction whose rate depends on the charge states of the reactants.

**38644 (N—8314712) Retrospect of solar cell development in West Germany.** Loesch, H.R. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). Jun 1982. 4p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 117-120 (SEE N83-14694).

Solar cell development in West Germany from 1963 onwards is described.

**38645 (N—8314713) NASA space photovoltaic research and technology programs.** Mullin, J.P.; Flood, D.J. (National Aeronautics and Space Administration, Washington, DC (USA)). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 121-126 (SEE N83-14694).

The NASA programs for increasing conversion efficiency, reduced mass and cost, and extending operating life of photovoltaic converters and arrays and for evaluating advanced solar array concepts are outlined. Research into radiation resistance and annealing, development of thin blankets, high-power low-cost arrays, and lightweight structures for near-Earth and planetary applications are discussed.

**38646 (N—8314714) TV-SAT solar array.** Urbain, G.; Rinn, C.; Bastard, J.L. (Societe Nationale Industrielle Aerospatiale, Cannes (France)). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 129-133 (SEE N83-14694).

The electrical and mechanical performance of the TV-SAT direct television broadcasting satellite is described. The 4.5 kW end of life 7.5yr array contains 43,200 back surface reflector solar cells. The first, 3.1 kW, array consists of two identical wings, providing power during transfer and geostationary orbit. Each wing is made up of four carbon fiber panels. The outboard panel of each wing is deployed at 90 deg in transfer orbit, during which the satellite is three axis stabilized.

**38647 (N—8314715) Further developments of the ECS solar array.** Vieleers, A.; Zijdemans, F. (Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 135-140 (SEE N83-14694).

The ECS/MARECS communications satellite modular solar array is described. The baseline array configuration provides 1000 W at 50 V for a minimum lifetime of 1 yr for ECS. The array consists of two wing assemblies, each having three identical panels hinged together and connected to the spacecraft via a yoke. The lightweight panel substrates are of the rigid sandwich concept 2240 solar cells are bonded onto each of the rectangular panels. The electrical baseline design configurations matches requirements of a regulated bus. No special battery charge sections are allocated. The power generating element is a 10 ohm-cm shallow diffused 20.95 x 40.35 mm high efficiency solar cell of 180 micron nominal thickness. Power-weight ratio is 26W/kg. Communication and scientific satellite applications are described.

**38648 (N—8314717) Primary calibration of high efficiency solar cells. A comparison of 1980 data from CNES, NASA (Lewis), JPL and RAE.** Crabb, R.L. (European Space Research and Technology Centre, Noordwijk (Netherlands)). Jun 1982. 7p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 149-155 (SEE N83-14694).

Calibration results are presented for 10 high efficiency n/p, 1 ohm-cm, 2x4cmx250 microns silicon solar cells embodying TiPdAg contacts, TiOx antireflection coatings and 150 microns thick cerium doped microsheet coverslides. Three cells were calibrated by NASA on a high altitude aircraft, two cells by CNES balloon, two cells by JPL balloon and four cells by RAE at sea level. All data points fell within a band of + or - 1% spread in short circuit current.

**38649 (N—8314718) Development and testing of a spacecraft surface potential monitor.** Valentan, D.; Levy, L.; Sarrail, D. (Societe Europeenne de Propulsion, Vernon (France)). Jun 1982. 4p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 157-160 (SEE N83-14694).

A surface potential monitor was developed in order to measure the electrostatic fields in solar cell covers. The measurement correlates electrostatic discharges occuring during geomagnetic substorm events and spacecraft disturbance. Monitor output can be used to drive an active spacecraft charging control system. An electromagnet induces vibration of a flat spring holding the sensing area. The spring oscillates at its fundamental frequency. Spring and sensing area mounted on an insulator. The resulting signal feeds a charge amplifier through a coaxial cable. A high impedance ac voltmeter can also be used. The monitor is designed to withstand geostationary environment for 7 yr. The test program includes environmental acceptance tests, functional acceptance tests under vacuum then environmental tests at qualification level, and geomagnetic substorm simulation tests.

**38650 (N—8314719) Announcement of an opportunity for space calibration of solar cells.** Suppa, E.G. (European Space Agency, 75 - Paris (France)). Jun 1982. 3p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 161-163 (SEE N83-14694).

The ESA solar cell calibration facility (SCCE) is described. The SCCE will operate regularly on shuttle pallet satellites. Specimen reference number short circuit current, open circuit voltage, and the temperature of experiment electronics are recorded for up to 32 cells. Overall measurement accuracy is better than + or - 1%.

**38651 (N—8314720) Large infrared test rig for vacuum temperature cycling tests in the ESTEC DTC.** Bonnot, P.; Brinkmann, P.W. (European Space Research and Technology Centre, Noordwijk (Netherlands)). Jun 1982. 8p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 165-172 (SEE N83-14694).

A rig for testing six INTELSAT 5 solar panels simultaneously was developed. It has three vertical rectangular LN2 shroud systems, which form two adjacent compartments, each 70

cm wide. Three solar panels can be suspended on rails in each compartment. The panels are almost completely enclosed by the shrouds, so that rapid transients can be achieved during temperature cycling. The solar panels are heated by an array of IR lamps in each compartment. The intensity distribution in the plane of the solar panels meets the required uniformity of + or - 10%. Mechanical interfaces are designed to allow easy adaptation to other programs.

**38852 (N—8314721) Loss currents of solar cells under Low Earth Orbit (LEO) conditions.** Stasek, G. (Physikalisch-Technische Studien G.m.b.H., Freiburg (West Germany)). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 173-177 (SEE N83-14694).

Loss currents through plasma for different solar cell samples were measured as a function of the potential difference, distance and angle against the plasma stream, in a plasma chamber. Loss currents of 2 micro A at 200 V for a solar panel, and a lower limit for typical discharge voltages of about 200 to 300 V for solar cells are reported. Dependencies of these quantities and test results show that current and discharge voltage are governed principally by the available charged particle densities, especially electrons, and the active sample surface. The area of these surfaces determines the current in the ohmic region whereas their geometry (edges, tips) governs the discharge voltage. In the discharge region secondary electron production increases the current.

**38853 (N—8314722) NASA solar array flight experiment.** Turner, G.; Hill, H. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 179-184 (SEE N83-14694).

The NASA large flexible solar array space shuttle flight experiment is described. The 32 x 4 m wing is deployed from the shuttle bay, and experiments in electrical output, multiple deployment, and structural dynamics are planned. Both 2 x 4 cm and 5.9 x 5.9 cm cell assemblies on the array blanket are evaluated. Safety/hazards provisions are described, including emergency jettison provisions. Ground testing and hardware fabrication are summarized.

**38854 (N—8314723) Analytical prediction of the dynamic in-orbit behavior of large flexible solar arrays.** Behrens, G. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Wedel (Germany, F.R.)). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 187-192 (SEE N83-14694).

The natural motions in terms of eigenfrequencies and modes of large flexible solar arrays were determined by the finite element method (FEM). The accuracy of the FE-model was verified and improved by static and dynamic analyses. Good agreement with flight test data was established.

**38855 (N—8314724) Space Telescope: Solar panel assembly thermal test analysis.** Jaekel, E.K.; Beere, G.I.M.; Aalders, B.G.M. (European Space Agency, Noordwikj (Netherlands)). Jun 1982. 8p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 193-200 (SEE N83-14694).

The Space Telescope solar panel assembly (ST-SPA) was tested in a thermal vacuum, for formal qualification and design verification of the SPA including the shunt diodes. The ST-SPA was instrumented with 60 thermocouples and 2 thermistors. In parallel to the thermal sensor readings, thermograms with an infrared camera were taken. Thermograms are reproduced, and updates of the thermal mathematical models are given. The use of a calibrated solar flux allowed an update of the thermo-optical properties for the SPA. Optical properties are: alpha S 0.53, Sigma H 0.76 for the rear side and alpha S 0.86, Sigma H 0.78 (unloaded) for the front. Solar cell and shunt diode temperature for flight environments are included.

**38856 (N—8314725) Extendible and retractable masts for solar array developments.** Vieleers, A.M.V.; Preiswerk, P.R. (Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.). Jun 1982. 7p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 201-207 (SEE N83-14694).

The Astromast instrument boom, and its applications in European and American space programs (e.g., L-Sat, Voyager) are described. In the continuous version the longitudinal beams (longerons) are elastically coiled when in their stowed configuration. In the articulated version the longerons are segmented and hinged, and are folded when in stowed configuration. For fully automated array deployment, the Astromast provides actuation and drive for articulations of the stowage boxes from their stowed position to the array deployment position, actuation and drive for release and reapplication of blanket preload pressure, and deployment and retraction of the solar array wing.

**38857 (N—8314726) CMX-50: A new ultra thin solar cell cover for lightweight arrays.** Taylor, H.; Simpson, A.F.; Dollery, A.A. (Pilkington Bros. Ltd., Ormskirk (UK)). Jun 1982. 4p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 211-214 (SEE N83-14694).

Developments which extend the available thickness range of cerium glass solar cell covers down to 0.050 mm are described. A continuous draw process offers a high volume, low cost solar cell cover material to integrate with thin silicon solar cells for the assembly of large area lightweight solar arrays. The cell covers are manufactured from an improved glass composition incorporating cerium dioxide. This glass (CMX) maintains UV cut-off and transmission properties to match the spectral response characteristics of current silicon solar cell types, provides the necessary UV rejection and ionizing particle radiation resistance, and has a high emittance value.

**38858 (SAND—83-1210C) Theoretical studies of strained-layer superlattices.** Osbourn, G.C. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 2p. (CONF-830551—1). NTIS, PC A02/MF A01. Order Number DE83012495.

From 5. SERI photovoltaic advanced research and development annual review meeting; Denver, CO, USA (19 May 1983).

Strained layer superlattices (SPS) form a broad new class of materials with potential photovoltaic applications. These are high quality superlattices grown from lattice-mismatched materials when the individual superlattice layers are kept thin and the lattice mismatch is totally accommodated by coherent strains in the layers. Theoretical results are briefly discussed for the GaAsP and InGaAs SPS systems. (LEW)

**38859 (SERI/CP—233-1723) Sixth DOE solar photochemistry research conference.** (Solar Energy Research Inst., Golden, CO (USA)). 1982. Contract AC02-77CH00178. 152p. (CONF-8206108—). NTIS, PC A08/MF A01. Order Number DE83000916.

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

Portions are illegible in microfiche products.

This volume contains the program of the meeting, a list of attendees, abstracts of the talks and of the posters, and a record of the questions and answers and discussion following each presentation. Individual talks were title listed for inclusion in the Energy Data Base.

38660 (SERI/CP—233-1723, pp 7-8) **Attempts to mimic the primary step of photosynthesis.** Bolton, J.R. (Univ. of Western Ontario, London). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38661 (SERI/CP—233-1723, pp 11-13) **Sensitization and quenching in the conversion of light energy into chemical energy.** Cristol, S.J. (Univ. of Colorado, Boulder). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38662 (SERI/CP—233-1723, pp 14-15) **Efficiency of light-energy conversion in photogalvanic cells and water cleavage systems.** Kozak, J.J. (Univ. of Notre Dame, IN). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38663 (SERI/CP—233-1723, pp 17-20) **Study of the photoelectrochemistry of organic dyes using attenuated total reflection techniques.** Spitler, M.T. (Mount Holyoke Coll., South Hadley, MA). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38664 (SERI/CP—233-1723, pp 21-24) **Dynamic aspects of the dye-sensitized photoconductivity of semiconductors.** Goncalves, A.M.P. (Temple Univ., Philadelphia, PA). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38665 (SERI/CP—233-1723, pp 25-26) **Mechanistic features of the photocatalysis of organic Redox reactions at irradiated semiconductor surfaces.** Fox, M.A. (Univ. of Texas, Austin). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38666 (SERI/CP—233-1723, pp 27-30) **Energetics of illuminated semiconductor-electrolyte interfaces.** Turner, J.A.; Parkinson, B.A.; Cooper, G.; Fornarini, L.; Nozik, A.J. (Solar Energy Research Inst., Golden, CO). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38667 (SERI/CP—233-1723, pp 31-37) **Photochemical energy storage: studies of inorganic photoassistance agents.** Wrighton, M.S. (Massachusetts Inst. of Tech., Cambridge). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38668 (SERI/CP—233-1723, pp 38-40) **Photodissociation of water over Fe-Si-O compound surfaces.** Somorjai, G.A. (Lawrence Berkeley Lab., CA). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38669 (SERI/CP—233-1723, pp 41-43) **Electrochemistry.** Feldberg, S.W.; Skotheim, T.; Smalley, J.F. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38670 (SERI/CP—233-1723, pp 47) **Microemulsions as photogalvanic cell fluids.** Mackay, R.A. (Drexel Univ., Philadelphia, PA). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38671 (SERI/CP—233-1723, pp 50-54) **Photoexcitation energy exchange in phospholipid vesicle walls.** Baker, D.; Otvos, J.W.; Calvin, M. (Lawrence Berkeley Lab., CA). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38672 (SERI/CP—233-1723, pp 61) **Long distance electron transfer by ions and excited states.** Miller, J.R.; Closs, G.L.; Huddleston, R.K.; Calcaterra, L.T.; Hartman, K.W. (Argonne National Lab., IL). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38673 (SERI/CP—233/1723, pp 91-96) **Characterization of the primary state of bacterial photosynthesis.** Norris, J.R. 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38674 (SERI/CP—233/1723, pp 101-104) **Energy transduction in green bacteria: likely primary acceptors.** Barkigia, K.M.; Forman, A.; Fujita, I.; Hanson, L.K.; Smith, K.M.; Fajer, J. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38675 (SERI/CP—233/1723, pp 108-111) **Investigation of the structure of photosynthetic reaction centers.** Kirste, B.; van Willigen, H. (Univ. of Massachusetts, Boston). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38676 (SERI/CP—233/1723, pp 119) **Visible-light-induced oxygen evolution studies.** Frank, A.J.; Honda, K.; Gratzel, M. 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38677 (SERI/CP—233-1723, pp 120) **Application of chronocoulometry to the study of adsorption at the semiconductor/electrolyte interface.** Turner, J.; Parkinson, B. (Solar Energy Research Inst., Golden, CO). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

38678 (SERI/CP—233/1723, pp 121) **Photoelectrochemical cells based on dehydrogenation of alcohols.** Chandrasekaran, K.; Otruba, J.; Braun, A.; Nicodem, D.; Whitten, D.G. (Univ. of North Carolina, Chapel Hill). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38679 (SERI/CP—233/1723, pp 123) **Time resolved photocurrents in $MoSe_2$ and $WSe_2$ photoelectrodes irradiated by nanosecond dye laser pulses.** Parkinson, B.A. (Solar Energy Research Inst., Golden, CO); Prybyla, S.G.; Struve, W.S. 1982. NTIS, PC A08/MF A01. Contract W-7405-ENG-82.

In Sixth DOE solar photochemistry research conference.

38680 (SERI/CP—233/1723, pp 129) **Model systems for artificial photosynthesis.** Connolly, J.S. (Solar Energy Research Inst., Golden, CO). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38681 (SERI/CP—233/1723, pp 135) **Interaction of chlorophylls a and b adsorbed with N,N-dimethylmyristamide to polyethylene particles swollen with tetradecane.** Seely, G.R.; Kusomoto, Y.; Senthilathipan, V. (Charles F. Kettering Research Lab., Yellow Springs, OH). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38682 (SERI/CP—233-1723, pp 112-114) **Mechanisms of photochemical energy conversion by chlorophyll.** Ford, W.E.; Tollin, G. (Univ. of Arizona, Tucson). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38683 (SERI/CP—233-1723, pp 138) **Photoelectrochemistry of new thiazine dye derivatives.** Souto, F.A. (Univ. of Puerto Rico, Mayaguez). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38684 (SERI/CP—233-1723, pp 139) **Molecular design for organic photovoltaic cells.** Bird, G.R.; Piechowski, A. (State Univ. of New Jersey, New Brunswick). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

38685 (SERI/TP—211-1931) **Promising thin-film solar cells: an overview.** Stone, J.L. (Solar Energy Research Inst., Golden, CO (USA)). May 1983. Contract AC02-77CH00178. 5p. (CONF-830420—3). NTIS, PC A02/MF A01. Order Number DE83011959.

From Society of Photo-Optical Instrumentation Engineers conference; Arlington, VA, USA (4 Apr 1983).

Several thin film solar cell materials have demonstrated greater than 10% conversion efficiency, including amorphous silicon, polycrystalline silicon, cadmium sulfide/copper sulfide, cadmium sulfide/copper indium diselenide, gallium arsenide (CLEFT), cadmium sulfide/cadmium telluride, and gallium arsenide/silicon. The generic category of thin film solar cells is examined to determine prerequisites for use of these materials for large quantities of competitive electrical energy production. The future extrapolated performance, low cost potential, and areas for further research are discussed.

38686 (SERI/TP—211-1959) **Electrochemical photovoltaic and photoelectrochemical storage cells based on II-IV polycrystalline thin-film materials.** Wallace, W.L. (Solar Energy Research Inst., Golden, CO (USA)). May 1983. Contract AC02-77CH00178. 7p. (CONF-830622—18). NTIS, PC A02/MF A01. Order Number DE83011957.

From American Solar Energy Society meeting; Minneapolis, MN, USA (1 Jun 1983).

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Research on electrochemical photovoltaic cells incorporating thin film CdSe and CdSe/sub x/Te/sub 1-x/ photoanodes has progressed to the point where efficiencies of up to 7% can be achieved on small area electrodes using a polysulfide electrolyte. Higher efficiencies can be obtained in alternate electrolytes in significantly less stable systems. The major limitations on cell efficiency are associated with the open circuit voltage and fill factor. At present, the most promising photoelectrochemical storage system is an in situ three electrode cell under investigation at the Weizmann Institute and consists of an n-CdSe/sub x/Te/sub 1-x/ photoanode and CoS counterelectrode in a sulfide/polysulfide electrolyte and a Sn/SnS storage electrode isolated in an aqueous sulfide electrolyte.

38687 (SERI/TP—211-1990) **Limits of photovoltaic conversion efficiency: a review.** Stone, J.L. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1983. Contract AC02-77CH00178. 23p. (CONF-830622—15). NTIS, PC A02/MF A01. Order Number DE83011958.

From American Solar Energy Society meeting; Minneapolis, MN, USA (1 Jun 1983).

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If photovoltaics is to gain widespread acceptance and become a viable part of the energy mix for this country, its cost-performance characteristics must be improved beyond where they are today. In particular, this translates into lower cost, higher efficiency, and longer life expectancy. Depending on the energy cost target, windows of opportunity exist which define the performance requirements. This paper examines the value of efficiency as related to making photovoltaics competitive with conventional electricity generating options and reviews the theoretical limits imposed on photovoltaic devices. Several approaches are examined which have potential for greater than 30% conversion efficiency and the current status of this development is reviewed.

38688 (SERI/TR—8041-6-T1) **Studies of fundamental growth problems in lattice-mismatched solar cells. Final report.** Hauser, J.R.; Kim, M.K.; Bedair, S.M. (North Carolina State Univ., Raleigh (USA). Dept. of Electrical Engineering). Feb 1982. Contract AC02-77CH00178. 134p. NTIS, PC A07/MF A01. Order Number DE83008485.

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The major objective of this research has been the investigation of basic growth problems and possible solutions to the problems for lattice mismatched solar cell structures. The lattice mismatched layers which have been investigated are GaInAs on GaAs substrates. This structure has possible applications to the bottom cell of high efficiency cascade solar cells. The work has concentrated on two general approaches to obtaining improbed quality lattice mismatched layers. First various substrate orientations have been investigated. Substrates oriented from the (100) direction toward the (111) direction appear to give improved quality in lattice mismatched layers of GaInAs. Orientations of $6^0$ toward the (111) and the (311) and (511) orientations appear to give the best quality growth. In the second approach, either a series of step graded layers or a series of superlattice layers have been grown between the substrate and the desired device layer. The initial evidence obtained in this work supports the concept that the superlattice technique does in fact improve the quality of the grown layer as evidenced by improved properties such as quantum efficiency of diodes fabricated in the superlattice structures. In summary, this work has identified two approaches which appear promising for improving the quality of solar cells grown in lattice mismatched materials systems.

38689 (SERI/TR—8119-2-T5) **Low-cost substrates for polycrystalline-silicon solar cells by electrodeposition processes. Final report.** Gass, W.R.; Witkowski, R.E.; Kanter, I.E.; Berringer, A.F.; Temofonte, T.A. II. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 21 Dec 1982. Contract AC02-77CH00178. 119p. NTIS, PC A06/MF A01. Order Number DE83013498.

The objectives of this progrm were to identify and develop economical electrolytic methods for depositing thin film polycrystalline silicon suitable for photovoltaic applications, and to fabricate solar cell structures utilizing this unique material. Free-standing and supported polycrystalline silicon sheet has been electroplated from molten salt electrolytes onto a variety of substrates. The deposited silicon has been utilized in the fabrication of photovoltaic devices. Technically and economically, the electrolytic approach for depositing photovoltaic grade thin film polycrystalline silicon is very promising. Additional experimentation is necessary to improve device performance by decreasing electrically active impurities in the deposited silicon.

38690 **Picosecond fluorescence lifetime measurements on dyes adsorbed at semiconductor and insulator surfaces.** Liang, Y. (Temple Univ., Philadelphia, PA); Ponte Goncalves, A.M.; Negus, D.K. *Journal of Physical Chemistry;* **87**: No. 1, 1-4(6 Jan 1983). Contract AC02-81ER10881.

Fluorescence lifetimes in the 50 to 60-ps range were measured for rhodamine B and eosin adsorbed on tin oxide and indium oxide surfaces. Somewhat shorter lifetimes were obtained for rhodamine B adsorbed on plain glass. Implications these results have for models of the dye-sensitized photoinjection into semiconductors are discussed.

**38691 Disequilibriums in series connected solar cells: an approach to the protection by parallel diodes.** Roger, J.A.; Massaad, S.; Posbic, J.; Pivot, J. (Universite' Lyon I, France). pp 301-305 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper presents the first systematic comparison between experiments and theory leading to a better understanding of the "hot spot" problem in PV arrays, and to a better determination of the major parameters influencing these disequilibriums. Measurements are performed on a single string of 408 series connected solar cells, and currents and dissipated power are recorded as a function of the number of cells that are protected by a given bypass diode. Experimental data are in a very good agreement with a theoretical approach, summarized here, that allows a more complete investigation; the cell's parameters, especially the shunt resistance, are found to govern the "hot spot" formation and influence the aptitude of the diode to protect the cells. Various leading conditions are considered, and numerical values are given. This paper describes also the data acquisition system designed in our laboratory, that will be extended to analyze in summer 1982 the mismatch effects and the possible disequilibriums in the 5 kW array of the Refuge des Evettes in France.

**38692 Flat plate module technology - overview.** Fabre, E. (Photowatt, Argenteuil, France). pp 346-352 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper presents a synthetic overview of the different technologies which can be used for manufacturing a photovoltaic module. The emphasis is stressed on the cost aspect. The whole process is divided into three steps:1) material preparation and shaping; 2) cell processing; 3) cell interconnection and encapsulation. The present state of the art and the general technical trends for the next five years are presented and discussed for each step, in the frame of the silicon technology. The respective contributions to the total cost are also discussed, in view of defining the general orientations for R + D which have to lead to drastic cost reduction. Once all these steps have been individually reviewed, it is most important to investigate the technical compatibility between all the different possible technologies in order to build up an economic and consistent process.

**38693 Solar generator performance with load matching to water electrolysis longterm averages and range of instantaneous efficiencies.** Freudenberg, K. (Sektion Physik der Universitat Muchen, F. R. Germany). pp 135-138 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The efficiency of producing hydrogen by solar energy conversion via solar cells and water electrolysis is determined by the performance of the solar cells, the efficiency of the electrolyser and the quality of load matching. The strong variations of solar generator characteristics in the varying conditions of Central European climate necessitate longterm monitoring of system performance. A solar generator is directly wired to an electronic similation of an advanced water electrolyser. System performance is monitored from January 15 to July 7, 1980. Instantaneous generator efficiencies are capricious, but average generator efficiencies at specified solar irradiance and ambient temperature are well behaved. Load matching losses amount to only 8.9% of the solar generators MPP output. Hydrogen production is calculated from the current through the load assuming 100% current efficiency of the water electrolysis. Starting from 10.0% generator efficiency an overall energetic efficiency of 8.0% is achieved for hydrogen production. The exergetic efficiency is 9.4%.

**38694 Photovoltaic power for walk-in coolers.** Selles, L.; Aubert, B. (SERI Renault Ingenierie, France). pp 139-143 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

For a system analysis, the association of photovoltaic cells with motor compressors used in small industrial cold stores has been investigated. With a view to assessing the market potential of photovoltaics for food conservation in hot climates and harsh environments, stand-alone walk-in coolers have been studied and sized for: internal volumes ranging from 5 to 30 $m^3$; and temperature levels between 0°C and 7°C. The alternative DC versus AC supply for the motor compressor has been analyzed with respect to specifications of the location site envisaged - very remote without technical staff available. To reduce routine maintenance a fully hermetic AC motor-compressor has been chosen in preference to a DC "open" compressor. Consequently a high efficiency (>90%) PWM 3 - phase 3 kVA inverter has been developed. A 10 $m^3$ capacity prototype powered by a 2.2 kW peak photovoltaic panel has been designed and is now being tested. By Fall '82, prototype will be sent to an agricultural centre in Ouagadougou (Upper Volta) for field testing.

**38695 Reliability and performance experience with flat-plate photovoltaic modules.** Ross, R.G. Jr. (Jet Propulsion Lab., Pasadena, CA). pp 169-178 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

As part of the United States National Photovoltaics Program, the Jet Propulsion Laboratory's Flat-Plate Solar Array (FSA) Project has maintained a comprehensive engineering sciences activity addressed to understanding the reliability attributes of terrestrial flat-plate photovoltaic arrays and to deriving analysis and design tools useful for achieving the high levels of reliability necessary for future large-scale application. This paper builds upon the field-performance experience gained from several years of photovoltaic system-application experiments and the research results stemming from the development of reliability design and analysis techniques. The result is an overview of the array reliability problem in total, and available means of achieving high reliability at minimum cost.

**38696 Recent progress in terrestrial photovoltaic collector technology.** Ferber, R.R. (Jet Propulsion Lab., Pasadena, CA). pp 364-368 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The U.S. Department of Energy's Photovoltaics Program has as a goal, the development of economic photovoltaic systems for terrestrial applications. A key element of a photovoltaic system is the collector, which converts the solar energy to electrical energy. The targeted cost for the collector is $0.70/Wp (1980$). Two collector concepts are being developed to meet this cost target: (1) flat-plate by the Jet Propulsion Laboratory Flat-Plate Solar Array Project, and (2) concentrator by the Sandia Laboratories. The achievement of the cost target is dependent upon the Technical Feasibility demonstration of a number of different R&D areas in coordination with industry. The current Administration R&D policy changes have impacted the Program direction; however, the advances in both flat-plate and concentrator technology suport the conclusions that collector R&D objectives are attainable.

**38697 Fast silicon-sheet growth with the supported-web method.** Grabmaier, J.G.; Foll, H.; Freienstein, B.; Geim, K. (Siemens AG, F.R. Germany). pp 976-979 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Directly grown Si ribbons or sheets are attractive for the manufacture of low-cost Si solar cells. Intensive research efforts have led to the development of ribbon growth methods that yield products suitable for the manufacture of efficient solar cells. However, the areal growth rates of most methods are rather small and this constitutes a serious obstacle to their large-scale implementation. The newly developed supported-web (S-Web) technique attempts to overcome this problem. It envisions the use of a carbon-fibre net which is pulled through a melt of liquid Si at a high pulling speed. Liquid films or webs of Si are spread out within the meshes of the net and crystallize some time after leaving the melt. In this way the formation and the crystallization of the Si ribbon is decoupled and very large areal growth rates should be possible. First experiments demonstrated the feasibility of this concept and pulling speeds of greater than or equal to 2 m/min have been achieved. Problems exist with respect to the crystalline quality and the topography of the specimens obtained.

38698 **Recent developments in multi-wire fixed abrasive slicing technique (FAST).** Schmid, F.; Khattak, C.P.; Smith, M.B.; Lynch, L.D. (Crystal Systems, Inc., Salem, MA). pp 980-984 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The FAST process has shown effective slicing of 10 cm and 15 cm diameter ingots at 25 and 19 wafers/cm respectively. Correlation of area generation rate with slicing parameters has shown a strong relationship to the pressure at the diamond tips. This pressure is increased by rocking the workpiece and thereby decreasing the contact length. The area generation rate varies linearly with the surface speed of the FAST slicer. Novel techniques of electroforming have been developed in fixing diamonds whereby a controlled, predetermined kerf can be achieved.

38699 **Critical technology limits to silicon material and sheet production.** Leipold, M.H. (California Inst. of Tech. Jet Propulsion Lab). pp 985-989 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The reduction in scope of the Flat-Plate Solar Array Project has resulted in sharply focusing the developments within the programs involving silicon material and silicon sheet production. This has been accomplished by limiting the research to those elements which have the most impact on the long-term potential of each process under development. Silicon material development efforts include two approaches. The first involves the production of high purity silane and conversion to silicon particles in a fluidized-bed reactor, specifically minimizing fines production and wall deposits and demonstrating purity. In the second, the dichlorosilane process, wall deposits in the rod reactor are limiting the conversion of dichlorosilane to silicon. Sheet preparation efforts involving Czochralski growth and wafering have largely been eliminated accompanied by reduction in casting development. Within ribbon development, the most critical elements here are reduction of ribbon stress and maintenance of flatness during high speed growth. Secondary efforts in improving conversion efficiency continue.

38700 **Economic viability of the UCP semicrystalline silicon sheet technology.** Putney, Z.; Rosenfield, T.; Wrigley, C. (Semix Incorporated, Gaithersburg, MD). pp 990-993 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—). Contract FC01-80ET23197.

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Extensive economic analysis performed under DOE sponsorship has shown that photovoltaics can be competitive with central power station grid electricity when the price of photovoltaic modules is reduced to below $0.07/Wp. This in turn requires a reduction in the cost of sheet material from which to fabricate cells. Starting from work begun in the early 1970's, Semix has developed a new industry, now some three years old, manufacturing semicrystalline silicon for photovoltaic cells. The Ubiquitous Crystallization Process (UCP) so developed is now approaching its second megawatt of output of semicrystalline silicon sheet. In a recent study employing the JPL SAMIS analysis it has been projected that at the 100 MWp annual level this industry can provide photovoltaic panels close to $0.05/Wp, well below the $0.70/Wp level, using the Semix-developed Simultaneously Present Large Impurity Technology (SPLIT) process for silicon feedstock. In conjunction with the UCP industry, the SPLIT feedstock, and mildly aggressive projections for near-term wafering technology solar cell efficiencies as low as 13%. Extension of the large-volume solar cell fabrication technology to maintain a 15% conversion efficiency, based upon recent developments on a smaller scale, results in a module cost projection of $0.52/Wp.

38701 **Comparison between various ion beam doping procedures and anneal techniques used in manufacturing silicon solar cells.** Muller, J.C. (Centre de Recherches Nucleaires, Strasbourg, France); Mesli, A.; Siffert, P.; Com-Nouque, J.; Tessari, C.; Dumas, J.P. pp 994-998 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Conventional ion implantation of phosphorus and ion incrustation (non mass separated $PF_5$ molecular ions), have been used to realize the $N^+$ layer of single cristalline silicon solar cells. Various regrowth techniques have been investigated : classical thermal threatment, laser annealing in the liquid and solid phase regimes and election beam annealing. A systematic investigation by DLTS has allowed the determination of the optimal conditions of the post thermal treatment. Finally, large scale cells ($\geqq$ 10 cm$^2$) have been prepared by using industrial processes and efficiencies higher than 13% have been measured for the two doping procedures. These techniques are presently applied to polycrystalline silicon from various sources. The first results obtained on solar cells elaborated with these materials, in particular the silicon under development at Laboratoires de Marcoussis are given in the paper.

38702 **Status of ion-implanted silicon solar cells.** Schmidt, W.; Rasch, K.D. (AEG-Telefunken, Heilbronn, F.R. Germany). pp 999-1006 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Ion implantation is considered as a possible low-cost "cold" process for junction formation in terrestrial solar cell fabrication. But it requires a subsequent implantation damage annealing step. Various annealing techniques as thermal treatment of irradiation with laser or electron beams have been applied. The results indicate for all annealing techniques lower efficiencies compared with standard diffused cells. The problems of annealing are discussed. The influence of a post-anneal heat treatment and of resistivity on the performance of pulsed electron beam annealed cells is evaluated.

38703 **Optimization of pulsed electron beam annealing process for silicon solar cells.** Laugier, A.; Barbier, D.; Chemisky, G. (Institut National des Sciences Appliquees de Lyon, France). pp 1007-1012 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Ion implanted silicon solar cells characteristics are related to pulsed electron beam annealing parameters (PEBA). Evolution of electron beam energy deposition profile versus charging voltage and plasma field emission diode geometry is studied. By computer simulation of thermal effects it is shown that molten depth and

liquid phase duration can be adjusted to yield the best ion implanted junction characteristics. Effect of heating Si wafers above 400°C before pulsing is investigated. SIMS profiling is used to determine junction profiles after PEBA in (100) phosphorous implanted silicon. PEBA solar cells characteristics are presented.

38704 **Silicon solar cells by ion implantation: e-beam and self annealing.** Cembali, G.F. (CNR-Instituto Lamel, Bologna, Italy); Galloni, R.; Lulli, G.; Mozzone, A.; Merli, P.G.; Nipoti, R. pp 1013-1017 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Two different techniques, based on ion implantation, have been experimented to obtain solar cells: a) ion implantation followed by electron beam annealing, b) self-annealed ion implantation. Silicon single crystals have been used to get a better understanding of the processes. In all cases radiation damage is annealed by a solid phase process. Solar cells tested at AM1.5 show efficiencies between 13 and 13.5% which may be compared with a 15% AM1.5 efficiency obtained by ion implantation and furnace annealing. Experimental results are compared with data obtained from a computer simulation to evaluate emitter tailoring effects. A new electron gun especially designed and set up for annealing purpose is presented.

38705 **An automated ion implant/pulse anneal machine for low cost silicon cell production.** Armini, A.J.; Bunker, S.N.; Spitzer, M.B. (Spire Corporation, Bedford, MA). pp 1018-1022 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The continuing development of a high throughout ion implanter and a pulsed electron beam annealer designed for dedicated silicon solar cell manufacture is reviewed. This equipment is intended for production of junctions in 10 cm wide wafers at a throughput up to 10 MW/sub p/ per year. The principal features of the implanter are the lack of mass analysis and defocusing utilizing electrostatic deflection. The implanted surface is annealed by liquid phase epitaxy resulting from a single burst of a large area electron beam. Cells with non-mass analyzed ion implantation have yielded AM1 cell efficiencies in excess of 15%. Pulse annealed Czochralski cells have been made with AM1 efficienceis of 13% vs. 15% for a furnace annealed group. J/sub sc/ is 3-4% higher for pulse annealing; V/sub oc/ is usually lower. Results of pulse annealing of polycrystalline materials indicate that cell performance comparable to diffusion can be obtained.

38706 **Laser processing in the preparation of high efficiency polycristalline silicon solar cells.** Courcelle, E.; Fogarassy, E.; Muller, J.C.; Siffert, P. (Centre De Recherches Nucleaires, Strasbourg, France). pp 1023-1028 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Two doping processes, based on the use of high power lasers as surface localized energy sources have been employed to realize the junction on P-type polycrystalline silicon, prepared by a cast technique (Wacker). Doping: non mass separated ion implantation, the ions being generated from $PF_5$; laser induced diffusion of Sb deposited on surface. Annealing: a Q-switched pulsed Ruby laser ($\lambda$ = 0.69 $\mu$m, E = 1.5 J/cm$^2$ providing a large area beam (phi 8 mm); a repetitively Q-switched, CW pumped Yag ($\lambda$ = 0.53 $\mu$m, E = 2.5 J/cm$^2$) laser focused on 100 microns diameter spots scanned on large area. The properties of the doped layers have been investigated and compared to that of single crystalline silicon handled in the same way. The characteristics of solar cells were studied as a function of various parameters, such as ion implantation conditions, thickness of the dopant layers and effect of post laser thermal treatments. Cell performances under AM1 conditions are rather promising, since efficiencies up to 11% have been achieved on large grained cast silicons for large area cells.

38707 **The influence of surface texture and thermal treatment on the performance of laser-annealed silicon solar cells.** Sinke, W.; Hoonhout, D.; Saris, F.W. (FOM-Inst. for Atomic and Molecular Physics, Amsterdam, The Netherlands). pp 1029-1033 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G.(eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Single-crystal silicon cells have been made by shallow, mass-analyzed ion-beam implantation followed by Q-switched ruby-laser annealing. The influence of surface texture of the substrate, and of a thermal treatment at 400°C or 600°C during 40 min. either prior to, during or after pulsed-laser annealing on the performance of the cells has been studied. Structure and composition of implanted and annealed silicon have been investigated by Rutherford Backscattering and channeling. Solar cell performance was characterized by measuring the I-V-curve. It was found that texturized surfaces are very prone to laser-induced damage as compared to non-texturized or polished surfaces. Treating the implanted silicon wafers to 400°C during pulsed-laser-annealing results in improved open-circuit-voltage, with respect to laser-annealing without substrate-heating. We found no evidence that prolonged thermal heating prior to or after pulsed-laser annealing can further improve cell performance.

38708 **Implantation of boron and boron fluoride compounds into silicon for production of solar cells.** Larsen, A.N.; Nielsen, F.; Sorensen, G. (Univ. of Aarhus, Denmark). pp 1034-1038 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The effects of pulsed laser irradiation on single crystalline silicon implanted with mass-separated B, BF, $BF_2$, and $BF_3$ have been studied by channeling, transmission electron microscopy, and sheet resistivity measurements. It is shown that a high implantation dose of fluorine in the surface layer causes a decrease in the threshold energy density for recrystallization. Low sheet resistivities before recrystallization is also found to correlate to the fluorine concentration.

38709 **Grain boundary photocurrent enhancement in solar cells made by laser diffusion.** Turner, G.B. (ARCO Solar, Inc., Chatwsorth, CA); Tarrant, D.; Aldrich, D.; Pressley, R.; Press, R. pp 1039-1043 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

An enhanced photocurrent has been observed at grain boundaries in solar cells made by Gas Immersion Laser Diffusion (GILD). Wafers of Wacker "Silso" polycrystalline material were sliced from the cast block, kept in order, and subjected to different treatments. Many grain boundaries extended through three wafers. One wafer was furnace-diffused with phosphorus (850°C, 1 hr) and the next was made by the GILD method. A third wafer was heat treated, without dopant, the same as the furnace-diffused cell. Laser photocurrent scans show that many grain boundaries degrade photocurrent in cells that have been heat treated but enhance it slightly in GILDed cells. Photocurrent scans on the backs of the cells show the effect strongly amplified. Two models are presented which are consistent with these results.

38710 **Dry process for economic cell manufacturing.** Donon, J.; Lauvray, P.; Aubril P.; David, G.; Loubly, P. (Photowatt International S.A., France). pp 1044-1048 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Different dry processes for cell manufacturing are under development leading to important cost reduction: PLASMA ETCHING in order to remove the thin damaged layer induced during sawing with a wire saw, to etch away the oxyde layer after diffusion and to open the junction on the edges; GENERAL USE OF SCREEN PRINTING in order to obtain N+/P and N+/P/P+ structures with screen printed doping sources, to print front and back contacts (silver can be used for the front, aluminium and silver for the back with the possibility of diffusing through the oxyde and the junction when needed), to deposit the A.R. coating, either at the end of the process or during the junction formation. The main advantages of these dry processes using plasma etching and screen printing are: low material consumption, high throughput versus capital investment ratio, little pollution, automation capability. A preliminary economic analysis is made to show the interest of using such a process in producton capacity.

38711 **Screen printed SIS-type solar cells.** Avaritsiotis, J.N. (Univ. of Athens, Greece); Campbell, D.S.; Caroubalos, C. pp 1053-1055 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The experimental results of a feasibility study that has been undertaken in order to investigate the potebiality of the thick film technology in the fabrication of ITO-single crystal Si solar cells, are discussed. Newly developed thick film pastes, in use in the optoelectrnics industry have been tried. In this structure the ITO thick film acts not only as a conducting surface layer that induces the SIS junction but also as an antireflective coating. Promising cells were fabricated employing conventional thick film apparatus that is widely used in the microelectronics industry, showing a V/sub oc/ = 310mV and a J/sub sc/ = 1mA/cm$^2$, under a total insolation of 613W/m$^2$. Further work is necessary for the optimisation of the cell parameters.

38712 **An improved derivation of solar cell parameters in terms of transition probabilities.** Landsberg, P.T. (The University, Southhampton, England). pp 1056-1058 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Using rate equation and quasi-chemical potentials, the relation j = j/sub L/ - j/sub rev/[exp(eV/kT)-1] is obtained. It yields identifications for j/sub L/ and j/sub rev/ in terms of radiative and non-radiative transition probabilities per unit time.

38713 **The world largest 12 volt single string photovoltaic module.** Lauwers, P.; Smekens, G.R. (Energies Nouvelles et Environnement SA, ENE, Belguim). pp 1063-1064 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper presents the world's largest nominal 12 Volt single string photovoltaic module ever made until today. It is a 1m$^2$ module consisting of 40 semicristalline cells, each 15 cm by 15 cm. The module delivers 72 Watt under 1000W/m2, AM-1.5 illumination. The results listed here are those of a first batch of 100 wafers processed from starting material to encapsulated module. The module was completed on May 12, 1982 for presentation as late news at the fourth European Photovoltaic Comference in Stresa.

38714 **Renewable fuels for the future.** Calvin, M. (Lawrence Berkeley Lab., CA). pp 11-21 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). (CONF-821121—). Contract AC03-76SF00098.

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

That we will require renewable fuels for the future seems an almost obligatory need. This will be largely due not only to the exhaustion of our existing clean hydrocarbon and possibly gas reserves, but to the almost intractable air pollution problem which the combustion of fossil carbon to carbon dioxide produces. The most immediate source of renewable fuel is of course the annually growing plants themselves. Some of these produce hydrocarbon directly and may be economic. In the more distant future the mechanisms by which the plant captures solar quanta and converts them into stable chemical form may be useful in devising totally synthetic devices that will do a similar thing.

38715 **Aquatic biomass as a source of fuels and chemicals.** Raymond, L.P. (Solar Energy Research Inst., Golden, CO). pp 75-82 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). (CONF-821121—).

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

The Aquatic Species Program (ASP) addresses the development of technologies that produce and utilize plant biomass species which naturally inhabit wetlands or submerged areas. Processes being developed through this program take advantage of the rapid growth rates, high yields, and extraordinary chemical compositions inherently associated with aquatic species. Emphasis is placed on salt tolerant species for cultivation on poorly utilized, low-value lands, where conventional agriculture is not economic. Candidate species are identified from (1) micralgae - unicellular plants that are natural factories for converting sunlight into high quality oils; (2) macroalgae - large, chemically unique plants that can be easily fermented to methane gas or alcohols; and (3) emergents - plants that grow rooted in waterways and boga, but are partially exposed above water. Within the next five years, the conditions and resources necessary for sustained systems operations are to be defined, design parameters examined, and experimental facilities developed. Succeeding years are planned to focus on resolving major technical hurdles in systems operations, integration, and component performance. This paper updates the technical progress in this program, describes several aspects of evolving systems concepts, and attempts to provide some perspectives based on potential economics.

38716 **Phycobilisomes.** Gantt, E. (Smithsonian Inst., Rockville, MD). *Annual Review of Plant Physiology;* **32**: 327-347(1981).

The review discusses recent attempts to elucidate the phycobilisome and phycobiliprotein structures, chromatic adaptation, phycobiliprotein synthesis, chromophore structure and evolutionary relationships of red algae and cyanobacteria. (JMT)

## 1406 Photovoltaic Power Systems

*REFER ALSO TO CITATION(S) 38578, 38610, 38613, 38853*

38717 **(N—8314694) Photovoltaic generators in space.** Burke, W.R. (European Space Agency, 75 - Paris (France)). Jun 1982. 331p. (In English and French). (CONF-8205183—; ESA-SP—1736). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

Solar array design and testing were discussed. Radiation damage, blankets, solar cells, and the status of NASA and ESA spacecraft solar energy development programs were considered. For individual titles, see N83-14695 through N83-14738.

38718 **(N—8314696) Low Earth orbit blanket technologies for the power range of 15-60 kW.** Bebermeier, H. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Wedel (Germany, F.R.)). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 3-7 (SEE N83-14694).

The development of a 3.2 x 50 m foldable solar array is discussed. The blanket skin has a homogeneous rear side wiring of

copper. A very thin foil is bonded onto the rear side of the glass fiber reinforced Kapton, giving extremely high in-plane and out-of-plane stiffness of the array compared to present technology. Metallic foil is also used to reinforce the hinge cusp and foldline cusp. The bending stiffness over the width of the array is optimized by the height and shape of the cusp and its reinforcement. Silicon or embossed Kapton damping cross elements (padding) placed in the solar cell corner gap, come down onto the center of the adjacent cell during retraction. A 5 x 5 cm silicon cell with back surface is used.

38719 **(N—8314697) Advanced rigid array.** Mawira, D. (Royal Netherlands Aircraft Factories Fokker, Amsterdam). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 9-14 (SEE N83-14694).

The development of an advanced rigid solar array designed to provide powers from 2 to 6 kW for medium class communications satellites is described. For satellites with single axis Sun tracking solar arrays, a rigid structure is suitable. A 50/50 percentage weight proportion, using back surface reflector/back surface field 100 microns solar cells, is possible. No interference problems are expected for the electrical system design.

38720 **(PNL-SA—11368) Appliance use in photovoltaic-powered residences.** Watts, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC06-76RL01830. 18p. (CONF-830366—1). NTIS, PC A02/MF A01. Order Number DE83013479.

From 1. national conference on PV applications, photovoltaics for research to reality; Cambridge, MA, USA (24 Mar 1983).

The photovoltaic-powered residence can be a gracious home equipped with modern electrical appliances. The selection of the electrical appliances should involve consideration of the type of power system selected. Some of the appliances available require much more expensive PV power-supply systems for their use than others. Some appliances offer more convenience and consume more electricity. Others simply consume more electricity because they are less efficient. The selection of the appliances can make the PV power supply more than ten times more expensive for one residence than for another with comparable life style. Budget PV power systems routinely meet the expectations of home owners. These owners of budget systems have started out with systems supplying their highest priorities first and have used alternate energy sources. This paper discusses the factors involved in appliance selection and the way in which they affect the cost of the PV power-supply system.

38721 **Matching the characteristics of batteries with solar cell modules.** Gay, C.F. (ARCO Solar, Inc., Chatsworth, CA); Kapur, V.K.; Pyle, B.; Rumburg, J.; Manfredi, A. pp 335-339 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper puts together the characteristics of the storage battery commonly used in worldwide photovoltaic applications with those of the photovoltaic generator and of the solar source. The natural matching of these characteristics may be exploited in meeting the typical requirements of the user. If the module is properly designed, and if due care is taken in battery installation for passive temperature control, there is no need for complex regulation of periodic adjustment. A well-designed photovoltaic module can function as both generator and controller, providing enhanced system reliability, lower system cost, and simpler operation for the user. The critical design parameter, the charging voltage delivered to the battery by the module, is determined by the number of cells in the series string.

38722 **Calculation to improve power conversion efficiency in photovoltaic systems.** Mas, A.; Garcia, J.; Closas, L.; Insausti, M.; Castaner, L. (ETSITB, Barcelona, Spain). pp 340-344 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper deals with several photovoltaic system configurations in order to improve the adaptation between a photovoltaic panel and an AC load, in low power applications. Panel to battery and battery to AC load interfaces are considered and their efficiencies evaluated for each configuration. Several values of the system main parameters, such as battery voltages, nominal output power and others, are also considered. Experimental results indicated that the panel to battery interface efficiency is substantially improved by inserting an adaptative battery interface (ABI). The behaviour of the battery to load interface for the configurations proposed is analyzed.

38723 **Simple transformerless inverter with automatic grid-tracking and negligible harmonic content for utility interactive photovoltaic systems.** Schmid, J.; Schatzle, R. (Fraunhofer-Institut fur Solare Energiesysteme, F. R. Germany). pp 316-319 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

For commercially competitive photovoltaic residential systems the costs of all components have to be reduced significantly. One of the most costly components is the DC-AC-Converter satisfying all the necessary safety requirements. Under these boundary conditions, the FhG developed a converter which is especially designed for photovoltaic application. The new converter has an excellent efficiency over a wide power range and it satisfies all necessary safety requirements without additional components. Because it contains only electronic components, further cost reduction can be expected.

38724 **A DC/AC modular interface for photovoltaic systems.** Van Gysel, M. (IDE, Belgium); Limbourg, N. pp 312-315 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The aims of this work are industrial design and prototype testing of a power conditioning interface specific for PV systems. The techniques chosen include modular design, microprocessor control, PWM transistor inverter with stored wave. The interface is able to convert AC/DC, synchronize with a grid, control a battery, and perform maximum power tracking. The module is 10 KW (15 KVA), 220 V DC input, regulated 220-380 3 phase output, and has an efficiency of 90 to 94% in the 10-100% load range with a total harmonic distorsion less than 3%.

38725 **Regulated converter circuit for direct photovoltaic energy feedback into the power grid.** Ceppi, P.; Ulmi, R.; Guekos, G. (Swiss Federal Inst. of Tech., Zurick, Switzerland). pp 320-324 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

A new regulated utility interactive (UI) inverter for direct photovoltaic energy feedback to the mains has been realized. The inverter acts as a current source, its output is a sinewave with negligible harmonic distortion and has a projected efficiency of over 90%. A novel maximum power tracking (MPT) strategy based on a simple current peak error detection is described.

**38726 Power conditioning in solar photovoltaic array applications.** Vachtsevanos, G.J.; Kalaitzakis, C.K.; Grimbas, E.J. (Democritus Univ. of Thrace, Xanthi, Greece). pp 325-329 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The design and implementation of appropriate power conditioning apparatus for the interconnected operation of PV arrays with the utility grid are presented. Problems of maximum power transfer from the PV array to the utility grid, reliaiblity of the interconnected system operation and component protection are addressed. Because of the intermittent nature of the available solar energy, the need for conversion of dc electrical power to ac and the fluctuating loads of the utility system, optimization methodologies and associated equipment are developed for converting the maximum available solar power to electrical form and transfering it to the grid. A dual methodology is adopted containing a theoretical - system simulation - study of the performance of the interconnected system and a parallel experimental facility for the implementation of the system design. Results indicate higher energy transfer efficiencies in combination with an increased quality and reliability of performance of the PV array - utility grid system.

**38727 Mismatch between batteries and two module types p.v. arrays--interest of d.c.-d.c. converters.** Gucher, P.; Roger, J.A.; Massaad, S.; Posbic, J.; Pivot, J. (Institut de Chimie et Physique, Universite de Lyon, France). pp 330-334 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper concerns the study of mismatch effects between P.V. arrays and batteries. Due to the modifications of the experimental conditions (depending on the battery's state of charge, the external temperature and light flux), it is not possible to extract at each time the maximum available power from a P.V. array. Similar problems result from the parallel use in the same array of different modules, mismatched effects being enhanced by the fact that different encapsulation leads to different equilibrium for the junctions. The relative power losses in both cases have been analyzed on a small system made of two kinds of modules. Extrapolation to high power P.V. arrays has been done and a D.C.-D.C. converter for 5 kW P.V. arrays is presented. The interest of converters in the case of large generators coupled to batteries is discussed and some applications are proposed.

**38728 Development and testing of a submersible motor pump driven by a solar cell generator.** Picmaus, E.; Kiessling, K.P. (KSB-Klein, Schanzlin & Bucker AG, F. R. Germany). pp 130-134 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

In application of submersible motor pumps the total system-efficiency is most important. The pump- and motor-efficiency of a submersible motor-pump of series-standard could be improved for each 10 points, using an asynchronous motor similar to series. The investigation of synchronous motors and brushless DC-motors proved no economical result. To convert DC-current delivered by solar cells into AC-current of variable frequency and voltage, a pulse-converter with MOS-power-transistors and a control-device considering the special demand of operation with solar cells was taken. It consists of on-off automatics and a maximum power point control-device. For testing the single components and the total system, a testing supply has been installed. As a result a total efficiency of 43% at nominal load and of 33% at 1/4 load was determined.

**38729 The photovoltaic-powered water desalination plant "SORO" - design, start up, operating experience.** Neuhausser, G.; Mohn, J.; Petersen, G. pp 67-73 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

In the framework of a Mexican-German agreement for scientific and technical cooperation a photovoltaic powered water desalination plant is operated jointly as a "remote stand-alone system" at Concepcion del Oro in the Mexican Federal State of Zacatecas. The solar cell array with a peak power of 2.4kW and a total area of 30 $m^2$ has been designed and fabricated. The reverse osmosis desalination plant using one module of plate and frame configuration was developed. The pretreatment system of the raw water, which is brackish water from a well at the test site, and the preparation of the site was done. The main objective of the plant with a fresh water output of approximately 1.5 $m^3$ per day is to demonstrate the reliability and the low maintenance requirements of a photvoltaic powered water desalination plant for the fresh water supply of a small remote community without connection to the public grid.

**38730 CNR programme for photovoltaics.** Elias, G. (CNR, Italy). pp 17-19 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

A general survey of Energy Project (PPE) of the National Research Council of Italy in general, and about its activity in the field of Properties and Technologies of Semiconductors is given. The Project was a 5-year research programme (1976-1981) concerning renewable energy resources and rational energy use. The general Project lines have been the following: 1) utilization of the so-called 'minor' energy and waste utilization; excluding research programmes of nuclear, hydraulic energy and oil products, fields in which the State Corporations are already working; 2) conservation studies and rational energy untilization in the field of road transport and building industry, besides other studies on innovation and improvement (energy storage, electro-chemical generation, heat pumps, enhanced engine efficiency, etc.); 3) research on normative and juridical aspects to give the law-maker some help to choose possible incentives for public or private industry in the energy field, providing at the same time for the organization and up-dating of the energy flux in Italy.

**38731 The ENEL's programmes in the field of photovoltaic conversion.** Fittipaldi, F. (ENEL, Rome, Italy). pp 13-16 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This article provides some information on the main programmes which the ENEL (Italian National Electricity Board) is now pursuing in the field of the photovoltaic conversion of solar energy.

**38732 Overview of the European Community's activities in photovoltaics.** Palz, W. (Commission of the European Communities, Brussels). pp 3-8 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The Commission of the European Communities is currently implementing a comprehensive programme on photovoltaics. This programme includes basic R + D work, module testing, development of pilot projects, demonstration projects and applications in developing countries. Particular attention is being paid to the development of expertise and production capabilities in industry and to strengthening cooperation between the various European countries.

38733 **The behaviour of large solar power stations in the Swiss Alps.** Real, M. (Swiss Federal Inst. for Reactor Research). pp 51-56 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Electric utility acceptance of solar cell power stations as a reliable electricity generation alternative will require sufficient experience and know how to allow the technology to expand in Switzerland. This acceptance will require successful resolution of a number of key issues. Among the commonly known problems related to solar electricity fed into the electrical grid, Switzerland is facing a somehow unique situation: for reason of land availability and higher solar insolation during the winter period, large solar power stations will have to be built in the higher regions of the Swiss Alps. The acceptance of solar electricity will therefore require the proof that large solar cell power plants are operational under the severe climatic conditions of the Alps. The objective of the test presented in this paper is to investigate this problem. Both full size test with a field of solar cells and scale model tests had shown, that at least at the chosen site during the test period of last winter, show and ice accumulation will only cause small losses of potential overall energy output of a photovoltaic power station.

38734 **Design, installation, and initial performance of 350-Kw photovoltaic power system for Saudi Arabian villages.** Huraib, F. (Midwest Resesarch Inst., Kansas City, MO); Khoshaim, B.; Al-Sani, A.; Imamura, M.S; Salim, A.A. pp 57-66 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper summarizes the design, fabrication, installation and initial performance of the world's largest photovoltaic (PV) power plant. The installation of this system was completed in August 1981, and a month later it began providing electrical power to three remote villages in Saudi Arabia. The facility includes a 350-kW photovoltaic array, 1-MW diesel powered generators, 1.6-MW-hr lead acid batteries, a 300-kVA inverter, dc and ac switchgear, 13.8-kV transformers, control and data acquisition subsystems, and solar weather monitoring subsystem. The PV array is a point focusing concentrator type which uses an acrylic Fresnel lens with a geometric concentration ratio of 40. The system operates in standalone and cogeneration modes and is capable of completely automatic operation. The most significant aspects of the project to date are as follows: 1) the turn-key operation was completed within 19 months after contract go-ahead, 2) array dc power output exceeded 375-kW in February 1982 at an array field efficiency of 20.4%, 3) concentrator array module progressed from development stage to a commercial high production type within a year, and 4) it has the first operational array field to employ optical concentrators. With essentially trouble-free shipping, installation, and start-up operatons, the project demostrated that the PV system is an excellent candidate as a rapidly deployable dispersed power generator in remote areas with no utility transmission system.

38735 **The UNDP World Bank solar pump project - preparing for phase II.** Fraenkel, P.L. (Intermediate Tech. Power Ltd., United Kingdom); Malik, M.A.; Wright, D.E. pp 74-80 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Phase I of the UNDP financed World Bank executed Project was undertaken by Consulting Engineers, Sir William Halcrow & Partners in association with the Intermediate Technology Development Group Ltd between July 1979 and July 1981. Its purpose was to review proposals for the utilization of solar energy for pumping water for irrigation purposes and to advise on the way the technology should be developed. The paper briefly summarizes the main findings of this part of the work. Although no definite plans for phase II can be made until funds for it have been approved by UNDP in 1983, the UNDP, World Bank and Consultants agreed there was useful work to be done in the interim period between the end of Phase I and the start of Phase II of the Project. A contract has therefore been placed by the World Bank under which the following actions are being progressed: continuation of Phase I field trials where appropriate; a study of the factors which have to be satisfied if solar pumps are to be viable for irrigation and water supply purposes; an assessment of ways in which prospective countries might participate in Phase II; the procurement and testing of PV commercial pumping systems; the evaluation of continuing development of thermal systems; further development of individual components in PV systems; and a study of manufacturing potential in selected developing countries. A brief description of these activities is given in the paper.

38736 **Application trends for photovoltaics.** Macomber, H.L. (Monegon, Ltd., Gaithersburg, MD). pp 30-39 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper presents the results of studies to develop forecasts of PV system application markets. These forecasts consider economic factors such as conventional energy costs now and in the futue, the relationship between world economic conditions, as represented by each country's Gross National Product, and energy demand; the cost potential for PV system technologies; and the application trends in the past and future. The application sectors analyzed are: remote, stand-alone systems; residual systems; service/commercial/industrial/institutional; and central utility systems. An overall market forecast is developed and this forecast is segmented into the four market sectors.

38737 **Residential applications of photovoltaics in the United States.** Strong, S.J. (Solar Design Associates, Lincoln, MA). pp 151-156 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The U.S. Department of Energy has predicted that residential photovoltaic applications will become cost-competitive with conventional utility-grid power during the 1980's - perhaps as early as 1986 in some regions of the country. This paper will present the results of early work in the design, engineering and construction of photovoltaic residences, including the design trade-offs involved in the integration of PV systems with passive solar architecture, using lived-in PV residences as case studies.

38738 **The potential for photovoltaics in Europe.** Starr, M.R. (Sir William Halcrow & Partners, Swindon, United Kingdom). pp 40-50 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

There has been considerable investment worldwide in photovoltaic technology, by both private and public agencies. In Europe, there is a major photovoltaic research and development programme co-ordinated and financially supported by the European Communities. A large worldwide market is expected to develop, with important opportunities for European exports, but what are the prospects of this technology as an energy resource for Europe itself? Could a significant proportion of Europe's total electricity production one day be derived from photovoltaics? This paper addresses these questions. After a review of the prospects for cost reduction, the economics of electricity generation by photovoltaics in comparison with conventional alternatives are discussed. Break-even costs and the approximate dates when these could be achieved are presented. Market prospects are then discussed for various applications in Europe, such as stand-alone systems, grid connected residential and industrial systems and central generating plants. Given official support and full co-operation from the utilities the total market for ap-

plications in Europe could be 1000 MWp per year by year 2000 and continue to grow rapidly for many years thereafter. By 2025, the total installed capacity of photovoltaic systems in Europe could exceed 200 GWp, generating about 10% of total electricity production.

**38739 United States Federal Photovoltaic Program status.** Prince, M.B.; Barrett, A.L. Jr. (US DOE). pp 20-27 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The strategy of the United States Federal Photovoltaic Program has been modified to stress long-range, high-risk, potentially high payoff reasearch. The level of Department of Energy funding for photovoltaics has been reduced to $74,000,000 for the present fiscal year. There are now more than 15 cell suppliers in the United States with approximately 5 MWp of annual sales amounting to $75,000,000 in facilities and R & D, and approximately 2,700 experiments have been fielded with government funds.

**38740 The Italian programme in photovoltaic solar energy.** Farinelli, U. (ENEA, Rome, Italy). pp 9-12 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Italy - as most parts of Europe - is densely populated and with an electric grid reaching nearly everywhere. Isolated houses for which an autonomous electricity generating system is less expensive than connecting them to the grid are few. A detailed study has shown there are a few thousands - a few peak MW of photovoltaic. To these, some minor islands in the Mediterranean should be added, for a few more MW's. A law being approved by the Italian Parliament gives a very consistent possibility of starting this operation, by allowing a government contribution of 80% of the capital cost for "photovoltaic systems (and for other renewable energy sources) for the production of electricity for rural buildings that are permanently inhabited by the farmer". A large scale application of photovoltaic systems, connected to the grid, even taking into account environmental and social incentives, is an objective for the year 2000 and beyond; at that point, however, even 1% of PV electricity generation in Italy would mean an installed peak capacity of several GW.

**38741 Fourth e. c. photovoltaic energy conference.** Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). 1102p. (CONF-820555—). Kluwer Boston, Inc., 190 Old Derby St., Hingham, MA.

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The 1982 Photovoltaic Solar Energy Conference, the fourth organized by the Commission of the European Communities, provided an international platform for the assessment of photovoltaic power generation, its present potential and its future developments. Photovoltaic generators, which are now employed in a large number of demonstration and pilot projects, have received growing attention and commercial interest. Progress in cell and module production has led to improved economy in operation and brought us nearer the goal of large scale electricity production. New approaches in science technology offer promising potential for the future.

**38742 Experiments on combined photovoltaic-aeolian electric generation in a residential stand-alone system.** Calzolari, P.U. (Universita di Bologna, Italy); Cardinali, G.C.; Garulli, A.; Nobili, D.; Zani, A. pp 106-110 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The general design guidelines and the main features of an experimental photovoltaic-aeolian plant, with some preliminary observations on its working, are presented. The system has been operating for over a year and it meets the basic domestic needs of a remote farm situated in a hilly district of Northern Italy (Passo Mandrioli in Emilia Romagna). The plant was preliminarily conceived by the regional administration board which has supplied the financial support. This is the first project of a plan intended to collect information on alternate energy systems operating in a real-world environment, with a view to its diffusion between potential users and national manufacturers. To this end, the plan has been designed to accomodate a complete set for acquisition, recording and first elaboration of the main variables (both meteorological and directly relevant to the operation of the system). Combined photovoltaic-aeolian generation was chosen on account of the expected complementary nature of the two sources during the year. Though extended through a limited period, the available data seem to confirm the above-mentioned characteristics and support the general design criteria which are based on them.

**38743 Simulations of the energy performance of a solar photovoltaic residence and hybrid electric automobile in Fresno, California.** Reuyl, J.S.; Schutt, R.D. pp 111-114 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

JSR Associates has designed an integrated system incorporating a solar photovoltaic residence and hybrid electric auto that collects, converts, stores, and distributes incident solar energy on the residence to meet the time-varying needs for energy in both the residence and auto, (2) provides a source of supplemental energy for the residence and auto on cloudy days, and (3) enables the auto to travel extended distances whenever the owner so wishes. This study analyzed the hour-by-hour energy performance of a system that could be built with 1980's technology. Thermal and electrical performance in both stand-alone and grid connected configurations were simulated with computer models using actual hourly solar and weather data for Fresno, California. Results of the study indicate that the integrated system works well as designed and uses a fraction of the energy required by a conventional residence and auto. A brief cost analysis indicates that the system will be competitive with grid electricity and conventional autos within this decade.

**38744 Alicudi Project.** Arcidiacono, V.; Corsi, S.; Iliceto, A.; Previ, A.; Taschini, A. (ENEL, Direzione Studi e Ricerche, Italy). pp 115-119 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The chief aim of the Alicudi Project is to evaluate the technical and financial feasibility of supplying small isolated communities with electric power, using a photovoltaic solar energy system. The experiment, conducted by ENEL, consists in the design, construction and operation, on a small island in the Aeolian Archipelago, of a plant for the production of electric power by means of a photovoltaic system. The plant is one of a series of experimental plants whose construction is being promoted and partly financed by the Commission of the European Communities, R & D Department.

**38745 Application and experience of photovoltaic pumps for irrigation in Pakistan.** Pallett, R.G.; Brabben, T.E. (Hydraulics Research Station Ltd., Wallingford, Oxon, United Kingdom). pp 125-129 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

In recent years considerable interest has been expressed in the use of solar power to pump water for either irrigation or water supply, in remote regions of developing countries where grid electricity does not exist and diesel oil is difficult and expensive to obtain. There is a need for a suitably sized small scale pumping system capable of supplying the water requirements of small-holder farmers, farming less than 3 hectares. Intermediate Technology In-

dustrial Services (ITIS) of the UK purchased 20 solar powered micro-irrigation units (Sun pumps), of which 18 were supplied by Solar Electrical International (SEI) and 2 units, incorporating batteries, were suplied by Lucas Energy Systems of the UK. Sun pumps were installed at research farms and private farms in Pakistan for a one year trial period with the objective of demonstrating, testing and evaluating the suitability of this technology to the needs of irrigated small holdings. The trials have proven this technology to be acceptable to the farmers who readily appreciated the benefits of using sun pumps; the absence of running costs, the ease of use and the independence gained by controlling their water supply. It was also very evident that the effectiveness of this low flow irrigation system is more dependent, than conventional irrigation water supplies, on the plot layout, channel conveyance system and the farmer's water management technique.

38746 **Technical and economic requirements for small-scale photovoltaic refrigerators.** Starr, M.R. (Sir William Halcrow & Partners, Swindon, UK); McNelis, B. pp 144-150 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

There is a great need for small refrigerators for hospitals and clinics in rural areas in developing countries, but conventionally powered units currently available have a number of disadvantages. Robust and reliable photovoltaic refrigerators could fulfill the need and the main technical requirements are described. The World Health Organisation and the US Government are currently engaged on testing programmes to identify suitable commercial products, but it is clear that there is scope for considerable technical improvement. Based on discounted cash flow analyses, photovoltaic refrigerators are shown to be cost competitive with the main alternative currently available. Large markets are foreseen when suitable systems become available.

38747 **Performance testing and module monitoring at the EC: necessary steps to develop cost-effective PV modules.** Krebs, K. (Joint Research Centre, Espra Establishment, Italy). pp 158-168 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Cost and reliability of modules are the most critical elements for any future large scale application of photovoltaics. The modular nature of photovoltaic generators allows use of fault-tolerant circuitry but economic solutions are only possible if cell and module failure rates are kept at very low levels. Testing is essential to reach this target but also to create confidence with users, research ministries and financing bodies. During the last few years the EC has made substantial investments to support this view: facilities have been built, test procedures were developed and an extensive module test program for all EC pilot plants has been started. A short description of motivations and activities is presented. It is expected that these efforts, combined with a later centralized data collection from all field experiments could contribute in an essential way to the further development of reliable and cost-effective photovoltaic modules.

38748 **Operational experience with intermediate flat-plate photovoltaic systems.** Risser, V.V.; Zwibel, H.S. (New Mexico Solar Energy Inst.). pp 179-183 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The New Mexico Solar Energy Institute has been involved in the design, construction, test, operation, and data analysis of two intermediate flat-plate PV systems since 1978. The 20-kilowatt peak system at El Paso, Texas, provides direct current power to an uninterruptible power supply. Operational since January 27, 1981, it has produced 37,300 kilowatt hours through March 31, 1982. The 100-kilowatt peak utility-grid-connected system at Lovington, New Mexico, has been operational since March 17, 1981, having produced 199,900 kilowatt hours direct current and 174,000 kilowatt hours alternating current through March 31, 1982. Primary user of this energy is a shopping center located approximately 1 kilometer from the system. Both systems operate automatically and unattended. The reliability of prime systems components has been quite high. NMSEI is collecting and analyzing data from both systems. The results are presented in this paper.

38749 **Operational experience with a 35-kWp concentrating photovoltaic system.** Spencer, R.M. (Acurex Corp.). pp 184-188 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Acurex Corporation completed the installation and startup of a 35-kWp concentrating photovoltaic power system in October 1981. This paper describes the operation and performance of the field during the first 6 months of operation. The system has performed at a lower level than predicted, partly due to the unusual climatic conditions experienced at the site. The operational experience indicates three problem areas in the system design. First, some receiver degradation has ocurred due to manufacturing defects which have been corrected. Second, the power conditioning unit has demonstrated low reliability in the Hawaiian environment. Third, corrosion problems associated with the site have accounted for a major portion of the required maintenance. Overall, the system has operated reliably, except for the power conditioning unit, and most system components do not show signs of degradation.

38750 **Solar photovoltaic systems in the development of Papua New Guinea.** Kinnell, G.H. (Energy Planning Unit, Konedobu, Papua New Guinea). pp 189-202 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

A firm policy has been adopted, based on sound scientific and engineering evaluation, knowledge and experience, to accept only good quality, safe, reliable and economic 'tropicalized' photovoltaic and associated equipment for the implementation of various projects undertaken in Papua New Guinea. Overseas manufacturers are fully advised of these requirements to enable them to consider all factors involved, with regard to low maintenance and operating costs. The simple solution for rural lighting has been to use standardized small low voltage DC lighting kits, on the basis of one per home, and not large PV AC systems supplying a complete village or patrol post. Village water supplies can be provided by photovoltaic pumping systems for as low as one fifth of the capital cost of complex water reticulation schemes. Details are discussed. The effectiveness of fluorescent lighting is compared with kerosene lighting and the results of simple photometric measurements are given. Battery types are discussed and reasons for selecting specific types are given. The effectiveness of fluorescent lighting is compared with kerosene lighting and the results of simple photometric measurements are given. Battery types are discussed and reasons for selecting specific types are given. Insolation measurements and records are discussed and comparisons given between the various provinces, particularly coastal and highlands regions. Finally, the future is presented with projections of the potential total number of systems required together with the possible cultural, social and economic impact when such a level is reached.

38751 **Field trial of rural solar photovoltaic system.** Basu, P.; Mukhopadhyay, K.; Banerjee, T.; Das, S.; Saha, H. (Univ. of Kalyani, W. Bengal, India). pp 203-209 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H,; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

A small stand-alone solar photovoltaic system using silicon solar cells has been set up in a village near Kalyani, India to meet two typical rural applications like a) village community cum adult literacy center, b) irrigation pumping. A television set of 65 watts and three fluorescent lamps of total 100 watts and a d.c pump set of about 300 watts are being used as load. Power conditioning units include high frequency dc-dc convertor for TV set, dc-ac invertor for fluorescent lamps. Separate storage batteries have been used for the nighttime and daytime load. The performance of a solar pump has been investigated for different options such as with or without storage battery to determine the cost effective option for stand-alone solar photovoltaic irrigation pumping. The balance of system (BOS) costs of this system has been established and compared with that reported in the U.S.A. The electrical and thermal performances of the solar cell modules have been investigated. The social impact of this system in the village has also been studied. These observations lead to some interesting features of a typical SPS in rural conditions in India.

38752 **Study of a photovoltaic concentrating system like "SOPHOCLE" in fluctuating mode.** Laurent, B.; Vui, P.V.; Vialaret, G. (CNRS, Laboratoire d'Automatique et d'Analyse des Systems, France). pp 212-216 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

SOPHOCLE is a Fresnel lenses concentration photovoltaic generator using silicon cells. It is tested under various climatic environments, by means of a measurement and registration system. The recorded data are treated at L.A.A.S. (Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse). Different parameters are studied to define the generator performances and the dispersion of solar characteristics at different places. Their analysis by Monte-Carlo method has allowed creation of a mathematical model, particularly for time constants, efficiency and storage. The purpose is to understand at any time the whole behaviour of the system by means of statistics on real data and to detect any eventual defects.

38753 **AM/PM: The rating system for photovoltaic modules.** Gay, C.F. (ARCO Solar, Inc., Chatsworth, CA). pp 353-361 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper defines an approach to straightforward measures and ratings for photovoltaic modules which match the energy user's needs. The rating measurement proposed, that of electric energy delivered (Wh/day), is based on a Standard Solar Day averaged over the year and the world, indexable according to climatological zones. This Standard Day sees a 24-hour average irradiance of 200 W/m$^2$, average temperature of 20°C. The required module measurement involves the typical peak-watt power output and sensitivity to temperature, light level, and spectral content. It then becomes possible for the energy user to estimate the cost per kilowatt-hour of electrical energy received over the life of the system. The paper illustrates the concept of and need for energy-based ratings by the demonstrating various case calculations for the standard day. One commercial module type rated at 40 peak watts has an AM/PM rating of 194/Wh/day.

38754 **Installation and evaluation of a simple photovoltaic pumping system in an Algerian village.** Mouhoub, A.; Benmalek, M. (Centre des Sciences et de la Technologie Nucleaires, Alger Gare, Algerie). pp 81-85 of Fourth e.c. Photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (In French)(CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

A study was made of a photovoltaic system for water pumping. This simple system was developed with the aim of needing no maintenance. In this view we were interested in direct coupling including neither battery storage nor adaptation circuits. The photovoltaic generator consists of a 500 W array suppling an half kW D.C motor. The pump used is a single stage centrifugal model. The system was placed in a small community and was tested during ten months to set down the main characteristics such as the electrical parameters and the influence of external agents for a real remote site. Analysis and discussion of the obtained results are reported.

38755 **Advanced system design for solar power plants.** Cordes, V.; Korupp, K.H. (AEG-Telefunken Neue Technologien, Raumfahrt, F.R. Germany). pp 89-93 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This report gives an overview on applied technology of Photovoltaic Systems as well as a view into the advanced subcomponent technology. It turns out more and more as a reliable source in the field of alternative energy. The now achieved standard of technology for complete systems as well as for subcomponents is already approved in various applications. In order to have the opportunity to build up power plants in the Megawatt range a continuous reduction of costs by intensive development work is necessary. In addition an approved wind generator technology would be a reasonable supplement for many applications and would decrease the storage part, which means a reduction of system costs.

38756 **The Mississippi County Community College large-scale demonstration project--a success story.** Smith, H.V. (Mississippi County Community College, Blytheville, AR). pp 94-96 of Fourth e.c. photovaltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The world's first large-scale photovoltaic concentrating system has now been completed and is operational. The project is located at Mississippi County Community College in Blytheville, Arkansas, U.S.A., and consists of a uniquely energy-conscious building with some 63,000 photovoltaic concentrator cells providing 320 kW (DOE standard) power. The system is actively cooled, single-axis tracking, and is designed for providing about 85 percent of the total energy needs of the 55,000 sq. ft. building.

38757 **TISO 15--15 kW experimental photovoltaic solar power plant.** Camani, M. (Dipartimento dell'ambiento, Bellinzona, Switzerland); Daldini, D.B.; Pamini, R.; Sabvade, G.; Solca, F.; Spinedi, C.; Zamboni, F.; Celio, T.; Giovannini, C. pp 97-100 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

TISO 15 is an experimental, utility line interactive photovoltaic installation. It is intended for the collection of practical data related with the direct immission of photovoltaic electrical energy into a standard AC utility grid. A flat-plate array subfield provides the electrical power to a 10 kW inverter interacting with the local mains. A second array subfield (5 kW) with flat-concentrating modules and a separate inverter will be installed later on this year.

38758 **A successful integration of solar energy in African life: Kolokani, Mali.** Levha, L. (Elf Solaire, Developpements energetiques, France). pp 120-124 of Fourth e. c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

The French comany ELF SOLAIRE provided the village of Kolokani, Mali with a solar generator. This improved the quality of life in the village, but was not immediately accepted by the residents. There were some initial problems with overloads and break-

downs which have now been resolved. The generator is primarily used to provide electricity for the hospital.

38759 **Low-cost structures and optimization of support structures.** Glockl, J.; Helm, P.; Trader, K. (WIP, F.R. Germany). pp 1050-1052 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

This paper presents a newly developed low-cost support structure for PV panels based on elements commonly used for fence construction. Thereafter trade-off methods to arrive at an optimization in terms of total costs for support structures have been described.

38760 **Light assisted pulsed annealing of photovoltaic silicon by microwave energy.** Chenevier, P.; Cohen, J.; Kamarinos, G. (Laboratoire de Physique des Composants a' Semiconducteurs, ERA CNRS, France). pp 1065-1067 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

A new method of pulsed annealing using microwave energy is recommended. This method allows annealings of sufficiently short duration (on the order of 100 ms) to operate in an ordinary clean room ambience, and to treat relatively large areas. Moreover, the total energy efficiency is far higher (up to 20 to 30%) than with a laser or electron beam. In addition, microwave generators also allow profiling the power pulse, so that the treatment can be accurately controlled.

38761 **Microprogrammed coupling system for photovoltaic generators with multiple receptors.** Chaumain, G.; Barlaud, M.; Rouan, P.; Requier, J. (Laboratoire de microinformatique et electronique appliquees aux energies renouvelables, ENSUT de Dakar, Senegal). pp 1068-1070 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H.; Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

When photovoltaic generators have a power greater than a few kilowatts, they are often coupled to multiple receptors of diverse characteristics. In such cases it is necessary to optimise their operation and arrange for the proper allocation of energy among them. Our aim is to present a set-up which achieves this optimization and distribution.

## 1407 Solar Thermal Power Systems

*REFER ALSO TO CITATION(S) 38853*

38762 **(N—8314666) A high temperature ceramic heat exchanger element for a solar thermal receiver. Final Report.** Strumpf, H.J.; Kotchick, D.M.; Coombs, M.G. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1982. 114p. (NASA-CR—169625). NTIS, PC A06/MF A01.

The development of a high-temperature ceramic heat exchanger element to be integrated into a solar receiver producing heated air was studied. A number of conceptual designs were developed for heat exchanger elements of differing configuration. These were evaluated with respect to thermal performance, pressure drop, structural integrity, and fabricability. The final design selection identified a finned ceramic shell as the most favorable concept. The shell is surrounded by a larger metallic shell. The flanges of the two shells are sealed to provide a leak-tight pressure vessel. The ceramic shell is to be fabricated by a innovative combination of slip casting the receiver walls and precision casting the heat transfer finned plates. The fins are bonded to the shell during firing. The unit is sized to produce 2150 F air at 2.7 atm pressure, with a pressure drop of about 2 percent of the inlet pressure. This size is compatible with a solar collector providing a receiver input of 85 kw(th). Fabrication of a one-half scale demonstrator ceramic receiver was completed.

38763 **(N—8314716) Preliminary results of Helios solar generator inflight performance evaluation.** Kehr, J.; Porsche, H. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfallenhofen (West Germany)). Jun 1982. 5p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p 143-147 (SEE N83-14694).

A technique which assesses the Helios 1 solar generator degradation by calculating equivalent flux from data measured in flight is presented. The degradation is normalized to the 0.985 AU regulator output power value of 214 W. The measured aphelion points summarize the degradation of one orbit. Nonmeasured points are linearly interpolated. Through 14 orbits, the solar generator degraded to 37.5% of its original performance. In order to separate solar cell radiation introduced degradation of the substrate from other effects, the particle intensities as measured by Helios experiments are converted to 1 MeV equivalent fluxes using damage coefficients. The temperature increase of the solar panels at the aphelion points can be related to the loss of light intensity arriving at the substrate because the absorbed intensity is approximately proportional to temperature according to Kirchhoff's law.

38764 **(PNL—4745) Solar thermal financing guidebook.** Williams, T.A.; Cole, R.J.; Brown, D.R.; Dirks, J.A.; Edelhertz, H.; Holmlund, I.; Malhotra, S.; Smith, S.A.; Sommers, P.; Willke, T.L. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 175p. NTIS, PC A08/MF A01. Order Number DE83012963.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

This guidebook contains information on alternative financing methods that could be used to develop solar thermal systems. The financing arrangements discussed include several lease alternatives, joint venture financing, R and D partnerships, industrial revenue bonds, and ordinary sales. In many situations, alternative financing arrangements can significantly enhance the economic attractiveness of solar thermal investments by providing a means to efficiently allocate elements of risk, return on investment, required capital investment, and tax benefits. A net present value approach is an appropriate method that can be used to investigate the economic attractiveness of alternative financing methods. Although other methods are applicable, the net present value approach has advantages of accounting for the time value of money, yielding a single valued solution to the financial analysis, focusing attention on the opportunity cost of capital, and being a commonly understood concept that is relatively simple to apply. A personal computer model for quickly assessing the present value of investments in solar thermal plants with alternative financing methods is presented in this guidebook. General types of financing arrangements that may be desirable for an individual can be chosen based on an assessment of his goals in investing in solar thermal systems and knowledge of the individual's tax situation. Once general financing arrangements have been selected, a screening analysis can quickly determine if the solar investment is worthy of detailed study.

38765 **(SAND—83-8021) Overview of the construction and start-up of the 10 MWe Solar Thermal Central Receiver Pilot Plant April 1983.** Bartel, J.J.; Skvarna, P.E. (Sandia National Labs., Livermore, CA (USA); Southern California Edison Co., Rosemead (USA)). Jun 1983. Contract AC04-76DP00789. 36p. NTIS, PC A03/MF A01. Order Number DE83013903.

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This report presents an overview of the construction and start-up of the 10 MWe Solar Thermal Central Receiver Pilot Plant in Barstow, California. The costs and schedule of the project are discussed, the planned test program is outlined, and significant experiences to date are presented.

**38766 (SAND—83-8216) Solar One: Solar-Thermal Central-Receiver Pilot Plant. 1982 meteorological data report.** (McDonnell Douglas Astronautics Co.-West, Huntington Beach, CA (USA)). Jun 1983. Contract AC04-76DP00789. 179p. NTIS, PC A09/MF A01. Order Number DE83013622.

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Meteorological data recorded at the Solar One 10 MWe Pilot Plant during a Startup and Initial Evaluation Test Program during 1982 are presented. Additionally, a General Plant Description is provided, plus specific information on the type, quantity, and location of meteorological equipment and instrumentation at the Power Plant which are being used to record the meteorological data.

**38767 (SAND—83-8217) Accuracy of the Barstow Solar-Thermal Pilot Plant cost estimates.** Radosevich, L.G. (Sandia National Labs., Livermore, CA (USA)). Jun 1983. Contract AC04-76DP00789. 19p. NTIS, PC A02/MF A01. Order Number DE83013623.

This report assesses the accuracy of the cost estimates for the 10 MWe Solar Thermal Central Receiver Pilot Plant, located near Barstow, California. A history of the Pilot Plant cost estimates is presented, and the effects of inflation are discussed. The history is also compared to cost estimating histories of other first-of-a-kind energy process plants.

**38768 (SAND—83-8224) Status of research on convective losses from solar central receivers.** Abrams, M. (Sandia Labs., Livermore, CA (USA)). Jun 1983. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01. Order Number DE83013282.

Progress in the worldwide capability of predicting the convective energy loss from solar central receivers is reviewed. The significant advances in the past three years have been in experimental areas. Baseline measurements of the convective heat transfer from large high-temperature surfaces, e.g., a flat plate and a cubical cavity, have been completed and empirical correlations have been obtained. Theoretical modeling activities have not kept pace with the experimental advances, however. Currently, the primary theoretical emphasis is the development and testing of turbulence models suitable for buoyant flows. Three major needs have been identified: the measurement of convective energy losses from operating solar central receivers; the continued development of theoretical models in spite of the relatively slow progress to date; and the quantification of the effects of atmospheric turbulence.

**38769 (SERI/TP—211-1960) Theoretical analysis of natural-convection towers for solar-energy conversion.** Lasier, D.D.; Jacobs, E.W. (Solar Energy Research Inst., Golden, CO (USA)). May 1983. Contract AC02-77CH00178. 12p. (CONF-830432—4). NTIS, PC A02/MF A01. Order Number DE83011956.

From Wind/solar energy conference; Kansas City, MO, USA (25 Apr 1983).

A theoretical study of solar-powered natural convection tower (chimney) performance is presented. Both heated and cooled towers are analyzed, the latter using evaporating water as the cooling mechanism. The results, which are applicable to any open-cycle configuration, show that the ideal conversion efficiencies of both heated and cooled natural convection towers are linear functions of height. The performance of a heated tower in an adiabatic atmospheric ideally approaches the Carnot efficiency limit of ~ 3.4%/km(1.0%/1000 ft). Including water pumping requirements, the ideal limit to cooled tower performance is ~ 2.75%/km(0.85%/1000 ft). Ambient atmospheric conditions such as vertical temperature gradient (lapse rate) and relative humidity can have significantly adverse effects on natural convection tower performance. The combined effects of lapse rate and ambient relative humidity are especially important for cooled natural convection towers.

**38770 Power generation with solar central receivers.** Hildebrandt, A.F. (Univ. of Houston, TX); Gretz, J. pp 451-457 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). (CONF-821121—).

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

Since April 12, 1982, Solar Pilot Plant One at Barstow, California, has supplied some 318 MW hours of electricity to the Southern California Edison (SCE) grid. When checkout procedures are completed in the Fall, the plant will be capable of providing electricity to about 7000 individuals, attesting to the success of the Central Receiver concept. This system collects the sun's rays on computer-driven heliostats and focuses heat to a boiler on a tower which produces commercial steam to run conventional turbine-generators. The pilot plant is a scaled version of a 100 MWe plant that can generate electricity equivalent to 100 million barrels of oil annually. By themselves or as hybrid plants with oil-fuel capability, solar plants can provide 0.5 quads of energy throughout the Southwest United States by the year 2000. The Central Receiver is being tested in a 1 MWe plant in Adrano, Sicily, a 2.5 MWe solar plant at Targassonne in the Eastern Pyrenees, and an 0.5 MWe solar plant at Tarbernas, Spain. A 1 MWe plant is under development in Japan. Experimental plants are being considered in the Soviet Union (3 MWe), Australia (1.5 MWe), and Germany (20 MWe). Industry is interested in the capability of the Central Receiver to produce process heat.

## 1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

*REFER ALSO TO CITATION(S) 38872*

**38771 (DOE/ERD—0020) Environmental readiness document: ocean thermal energy conversion.** (USDOE Assistant Secretary for Environment, Washington, DC). Aug 1979. 37p. NTIS, PC A03/MF A01. Order Number DE83013416.

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This document addresses the uncertainties about environmental aspects of OTEC that remain to be resolved through research and development. The impacts and concerns presented in the document are treated generically without reference to specific predetermined sites unless these are known. Hence, site-specific implications are not generally included in the assessment. The report contains two main sections, III and IV, as well as Appendices. Section III highlights the characteristics of the technology, provides a status report on the technical and environmental R and D programs, presents a milestone chart representing a relationship between a considered commercialization schedule and relevant environmental R and D, and reviews the environmental concerns significant to the technology. Information pertinent to the technology R and D program was drawn from the technology program office and the current Environmental Development Plan. Section IV examines the likelihood and consequences of adverse findings, the problems and uncertainties stemming from current or anticipated environmental regulation, and potential costs of environmental controls. On this basis, an assessment of the existing or potential barriers to commercialization is made. Appendix A evaluates information available and summarizes the requirements for additional information or control technology. Appendix B is a summary of DOE's present OTEC-related environmental R and D resources and requirements. Appendix C is an annotated bibliography based on research categories used in the Inventory of Federal Energy-Related Environment and Safety Research.

## 1409 Solar Thermal Utilization

*REFER ALSO TO CITATION(S) 38609, 39028, 39029, 39030, 39033, 39034*

**38772 (CONF-820940—) Proceedings of the passive and hybrid solar energy update.** (MCC Associates, Silver Spring, MD (USA); Rockwell International Corp., Canoga Park, CA (USA)). Nov 1982. Contract AC03-76SF00700. 375p. NTIS, PC A16/MF A01. Order Number DE83007242.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

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Separate abstracts were prepared for thirty-seven papers. Eight papers were abstracted previously for EDB. (MHR)

**38773** (CONF-820940—, pp 15-32) **Passive cooling technology assessment: synthesis report.** Carroll, W.L. (Lawrence Berkeley Lab., CA); Webster, T.L.; Mertol, A. Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The cooling assessment investigated the interaction of three key variables: passive technology, building type, and climate. Four passive cooling technologies are evaluated by detailed, computerized energy performance simulations of one-story and 10-story office buildings. Eleven regions were used to describe the range of climatic conditions for cooling in the US. Lighting dominates the electric consumption in all climate regions examined. Cooling is the dominant cause of peak electric power. (MHD)

**38774** (CONF-820940—, pp 88-92) **New Mexico State University passive solar house.** Mancini, T.R. (New Mexico State Univ., Las Cruces). Nov 1982. NTIS, PC A16/MF A01. Contract AC03-80CS30228.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The New Mexico State University Passive Solar House is of the Skytherm type in which roof ponds and movable insulation are used to control the collection and rejection of energy for the heating and cooling of the interior space. Some of the results of the 1981 and 1982 cooling season tests are presented. These include the effects of deflated air cells, a change of water pond depth from 7.5 to 15 cm, and the effects of evaporative cooling and panel control on the performance of the system.

**38775** (CONF-820940—, pp 130-136) **DOE passive solar commercial buildings program: performance evaluation.** Gordon, H.T.; Fisher, W.J. (Burt Hill Kosar Rittelmann Associates, Washington, DC). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The 450,000 sq ft of passive commercial space involved in this program are expected to use about 50% less energy than conventional alternatives. This benefit was achieved at a cost increase of 5 to 10% compared to conventional buildings. Performance evaluation methods have been developed which will reduce the energy use and occupant response to these buildings to be compared to conventional alternatives. (MHR)

**38776** (CONF-820940—, pp 137-145) **Design, construction and initial monitoring.** Schade, J.R. (Johnson Controls, Inc., Milwaukee, WI). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The passive design process and the resulting building are described. Topics covered include: organizational and program objectives, programming and design, role of internal review, base case vs proposed passive design, role of passive design concept, construction, initial performance, and user response. (MHR)

**38777** (CONF-820940—, pp 146-149) **Energy performance of a passive solar bank building in Minnesota.** Weidt, J. (John Weidt Assocites, Inc., Chaska, MN). Nov 1982. NTIS, PC A16/MF A01. Contract FC02-80CS30353.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The performance of the first 5 months of submetered data on the Security State Bank of Wells, Minnesota is reported and the comparison of actual vs. estimated performance of the facility is emphasized.

**38778** (CONF-820940—, pp 157-160) **Slide presentation on commercial industrial passive solar buildings project.** Strain, K. (Tennessee Valley Authority, Chattanooga). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The intent of the Commercial and Industrial Passive Buildings Program is to significantly influence the development of a more energy efficient commercial and industrial (C and I) buildings stock. This program seeks to influence the design of as many as possible of the 2000 new C and I buildings constructed annually within the TVA region. The program also attempts to influence as many as possible of the 93,000 existing buildings which in 1979 constituted just under one billion square feet of C and I buildings. The goal of the program is to assist owners and designers of C and I buildings in their efforts to manage and design buildings that require less energy. The methodology to achieve these goals is composed of three primary components: Technical Assistance and Design Assistance, Design Guidelines, and Demonstration and Monitoring. These components are described.

**38779** (CONF-820940—, pp 161-170) **Passive solar commercial buildings program, Gunnison County Airport Terminal.** Kreider, J.F. (Jan F. Kreider and Associates, Boulder, CO); Waller, L.H. Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The preliminary results of solar system performance studies carried out on the final construction of a passive space heating system for the Gunnison County Airport Terminal are presented. The principal topic is the economic performance of the system with supporting material on thermal performance and system design.

**38780** (CONF-820940—, pp 171-175) **CUMC school: the first year.** Peckham, N. (Peckham and Wright Architects, Inc., Columbia, MO). Nov 1982. NTIS, PC A16/MF A01. Contract FC02-80CS30334.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The history and performance of the Community United Methodist Church passive solar school building is described. The building has performed close to predicted performance and much beter than expected by the users. Positive community response is mentioned. (MHR)

**38781** (CONF-820940—, pp 176-182) **Performance of a retrofit office/store in Wausau, Wisconsin.** Kieffer, B.D. (North Design A/E/P, Madison, WI). Nov 1982. NTIS, PC A16/MF A01. Contract FC02-80CS30343.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

A prototypical passive solar commercial building addition has been designed and constructed in Wausau, WI. The project is currently in Phase III of the program with its performance being monitored and evaluated. The performance of the building has been evaluated through the end of May. Performance through Fall, Winter, and Spring has been documented and analyzed. Significant variations between projected and actual energy use were observed. A detailed analysis of the data indicated the reasons for these variations and are noted.

**38782** (CONF-820940—, pp 183-185) **Energy in architecture: the AIA Energy Professional Development Program.** Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The Energy in Architecture Professional Development Program is a comprehensive, incremental program designed to provide energy professional with the knowledge and skills necessary to incorporate energy considerations into the design process. Divided into levels of increasing proficiency, the program is targeted toward the energy-concerned design professional. It promises to show participants how they can substantially reduce energy consumption in buildings through careful design, based on knowledge of energy principles and analyses of alternative strategies. A brief description of the program is given.

**38783** (CONF-820940—, pp 186-193) **Passive solar manufactured buildings development and analysis.** deKieffer, R.; Taylor, R.; Brant, S.; Simms, D. (Solar Energy Research Inst., Golden, CO). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Manufactured buildings are quickly becoming the most cost-effective residential and light commercial buildings in the American marketplace. Over the past three years the Solar Energy Research Institute (SERI) and the Department of Energy (DOE) have worked with building manufacturers to design, develop, and build passive solar manufactured buildings. This development process has lead to extremely valuable information in design development and design options, cost analysis, and estimated and monitored thermal performance on all types of manufactured buildings. Because of the tight cost/marketing restrictions in this industry, the lessons learned in this program are beneficial to all sections of the design and building community. The scope and content of this data are described by using a case study developed for the program.

**38784** (CONF-820940—, pp 194-199) **Passive and hybrid solar heating for manufactured housing.** Usry, J.D. (USRY, Inc., Richmond, VA). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Two modular passive solar homes have been erected and completed. Both are located in Richmond, Virginia, on the Usry sales center. The first home, the Solarium, with its 1500 square feet was completed in April of 1982. The second home, the Direct Gain, 1100 square feet, was completed August 1982. Both homes are being monitored by the Solar Energy Research Institute with the Aoleian Kinetics PDL 24 microprocessor. Monitoring will continue until September 1983, in order to determine heating and cooling loads.

**38785** (CONF-820940—, pp 200-205) **Independence project: marketing and performance analysis of panelized passive solar homes.** Milliken, A.N.; Slote, J.A. (Acorn Structures, Inc., Concord, MA). Nov 1982. NTIS, PC A16/MF A01. Contract FC02-80CS30363.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The Independence Series consists of four similar floor plans in sizes ranging from 1400 to 1900 square feet. The designs were completed by the end of 1979 and promotional and descriptive literature was released in October 1980. A model of the Independence III was constructed in Boulder, Colorado and finished in May 1981. It has been visited by thousands of interested consumers and professionals during the last 18 months and during the last year considerable performance data has been gathered by monitoring devices and record keeping. Meanwhile along the eastern seaboard, which is Acorn's prime market area, a number of Independence houses have been built. Results for the 1981-1982 heating season show that auxiliary space heating energy consumption was 2.4 Btu/(ft.$^2$xDD), higher than the original prediction of 1.4. The seasonal solar heating fraction was .68, matching the Acorn prediction exactly but falling short of the Berkeley Solar Group's .81. The biggest surprise was the low efficiency of the electric forced-air heating system, which was measured at .66. When the performance indices are re-calculated using the measured heating system efficiency, the predictions and the actual performance are in fair agreement.

**38786** (CONF-820940—, pp 206-212) **National Solar Data Network (NSDN) passive program.** Pollock, E.O. (Automation Industries, Inc., Silver Spring, MD). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Performance of eleven passive space heating systems, eight residential and three commercial, was evaluated during the past heating season. System types included low mass direct gain, high mass direct gain, Trombe wall, sunspace and double envelope designs. Performance for each of the systems is reported.

**38787** (CONF-820940—, pp 213-219) **Consumer perspective.** Shindelar, C. (Better Homes and Gardens, Des Moines, IA). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The consumer perspective on solar energy is explored through a study of responses to surveys conducted by Better Homes and Gardens magazine over the past several years. The consumer interest in saving money and reliability is shown. Changes in consumer attitudes over a five year period are discussed. (MHR)

**38788** (CONF-820940—, pp 220-226) **Evaluating how passive solar houses affect electric utilities.** Wood, R.A.; DeDuck, P.F.; Siegel, M.D. (JBF Scientific Corp., Wilmington, MA). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Methodology and results are presented for the Electric Power Research Institute's Passive Solar Energy Study. Results are presented for 2 utilities: Public Service Company of New Mexico (PNM) and Alabama Power Company (APCo). A comparison is made between conventional, energy conservation, and passive solar housing types. Preferred housing types are discussed that minimize the total of homeowner equipment costs, and utility energy and demand costs.

**38789** (CONF-820940—, pp 227-235) **Materials research for passive systems: solid-state phase change materials and polymer photodegradation.** Benson, D.K.; Webb, J.D.; Burrows, R.; McFadden, J.O.; Christensen, C. (Solar Energy Research Inst., Golden, CO). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

A set of solid-state phase change materials is being evaluated for possible use in passive solar thermal energy storage systems. The most promising materials are organic solid solutions of pentaerythritol ($C_5H_{12}O_4$), pentaglycerine ($C_5H_{12}O_3$) and neopentyl glycol ($C_5H_{12}O_2$). Solid solution mixtures of these compounds can be tailored so that they exhibit solid-to-solid phase transformations at any desired temperature within the range from less than 25 to 188°C, and with latent heats of transformation between 20 and 70 calories/gram. The transformation temperature, specific heats and latent heats of transformation have been measured for a number of these materials. Limited cyclic experiments suggest that the solid-solutions are stable. These phase change materials exhibit large amounts of super cooling; however, the addition of certain nucleating agents as particulate dispersions in the solid, phase change material greatly reduces this effect. Computer simulations suggest that the use of an optimized solid-state change material in a Trombe wall could provide better performance than a plain concrete Trombe wall. A novel technique for studying the photodegradation of polymers was also explored as a small part of this research. It was shown that Fourier Transform Infrared (FTIR) spectroscopy could be used to measure chemical changes as they occur in polymer films during simulated solar irradiation. In polymers such as polycarbonates which undergo rapid solar degradation, measurable changes could be observed by FTIR spectroscopy in a few minutes. In polymers such as polymethyl methacrylate, chemical changes could be measured only if the irradiation wavelength was extended down to about 270 nm.

**38790** (CONF-820940—, pp 236-242) **High performance windows for passive solar.** Brown, S.B. (Southwall Corp., Palo Alto, CA). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Heat Mirror transparent insulation for both passive solar and energy conservation designs is discussed. The benefits of Heat Mirror are described at length. (MHR)

**38791** (CONF-820940—, pp 243-250) **Product performance goals for the development of radiative cooling material. Phase III.** Compton, J.A. (Energy Materials Research Co., Berkeley, CA). Nov 1982. NTIS, PC A16/MF A01. Contract FC03-80SF11504.

From Passive and hybrid solar energy u 'ate conference; Washington, DC, USA (15 Sep 1982).

The cooling performance of horizontal radiative cooling panels is analyzed via simple BASIC computer programs. Emphasis is placed on determining minimum properties of glazing materials which will allow daytime cooling. The Zero Point is defined as the magnitude of insolation necessary to exactly counteract a panel's

cooling power. Plots of the Zero Point vs various material properties will then show which material combinations allow daytime cooling. Conclusions: necessary solar reflectances for polyethylene glazings range between 0.60 to 0.93 depending on glazing infra-red (IR) properties, glazing solar absorptance and solar properties of radiator (emitter). IR selective radiators significantly reduce (below range listed above) necessary glazing solar reflectance when glazing is also solar absorptive.

38792 (CONF-820940—, pp 251-256) **Thermal testing of passive/hybrid solar components.** McCabe, M.E. (National Bureau of Standards, Washington, DC). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Studies of thermal performance of passive solar buildings have indicated a need for precise field measurement of solar heat gain and thermal heat loss or gain for modular passive/hybrid solar components. A description of the conceptual design and the major assemblies and subsystems for a new calorimetric test facility is presented. The facility is designed for field testing of passive solar components at the National Bureau of Standards in Gaithersburg, Maryland. The test facility metering chamber can accommodate test articles having nominal dimensions up to 1.26 x 2.09 m (49 1/2" x 82 1/2") corresponding to a standard sliding door, with thicknesses up to 410 mm (16 in). The test articles are installed in the building envelope and can be oriented either to the vertical-south, or to the horizontal-upward facing direction. The metering chamber is designed to simulate an ideal indoor thermal environment by absorbing all the solar energy transmitted by the test article and by matintaining the indoor air and surface temperatures at controlled values between 15.6 and 26.7°C (60 and 80°F). A description of the passive/hybrid solar components proposed for testing in the calorimeter during the winter season of 1982-1983 is provided.

38793 (CONF-820940—, pp 266-269) **Variable transmittance electrochromic windows for passive solar applications.** Rauh, R.D. (EIC Labs., Inc., Newton, MA). Nov 1982. NTIS, PC A16/MF A01. Contract AC02-82CE30746.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Electrochromic windows can be used for linear variation of transmission and/or reflection of light. Such windows can be useful in passive solar space conditioning, as the entering sunlight can be subjected to thermal or optical feedback control. The present work describes window structures comprised of $WO_3$ and/or Prussian blue electrochromic elements combined with thin layer solid or semisolid electrolytes.

38794 (CONF-820940—, pp 279-284) **Instrumentation guidelines manual for passive solar test facilities: heat flux sensors.** Darnell, A.J.; Ingle, W.B.; McCoy, L.R. (Rockwell International, Canoga Park, CA). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The published literature has been searched concerning the theory, construction, calibration, and use of heat flux sensors. These data were examined in respect to their use in the measurement of heat flux for the evaluation of passive solar structures. Six heat flux sensors were purchased and subsequently calibrated by an independent testing laboratory. The results showed significant differences in sensitivity (10 to 30%) from the manufacturers' data. A method has been designed for the aging and stabilization of polystyrene bead-board, commonly used for insulation calibration standards. A guarded hot box apparatus was constructed to study the factors affecting the mounting and use of heat flux sensors.

38795 (CONF-820940—, pp 285-289) **Modular passive solar home.** Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Due to the dramatic rise of energy prices in the 1970's and the fact that Dynamic Homes' market is in the upper midwest, energy conservation has always been an important priority in the design and construction of their homes. Solar energy rose in popularity in the 1970's and seemed to be an ideal compliment to the already energy efficient Dynamic Home. All that was needed was a boost to get started. The program that got Dynamic Homes started into marketing solar homes is described.

38796 (CONF-820940—, pp 290-295) **Initial performance of the MIT Crystal Pavilion.** Johnson, T.E.; Hubbell, B. (Massachusetts Inst. of Tech., Cambridge). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Many winter climates in the US and Europe can be characterized as 'benign', where most of the days are cloudy, yet air temperatures rarely go below 6°C (42°F). The MIT Crystal Pavilion has been built to demonstrate 100% solar heating can be accomplished in these climates using the diffuse radiation that filters through the clouds. The vertical surfaces on the 46 $m^2$ (490 $ft^2$) addition to the MIT Solar Building No. 5 are glazed with double glass filled with argon and coated on one side with a transparent low emissivity layer that gives an overall average solar transmission of 63% and a nighttime U value of 1.24 $w/m^{2o}C$. The roof is double glazed with a low emissivity reflective glass and a laminated glass to reject summer solar gains. The floor is veneered with titles filled with phase change material to store any beam energy that is available. The building was completed for monitoring during February 1982. Initial measurements showed the building experiences a daily average lift of 10.3°C above ambient outdoor air temperatures during cloudy days. (Internal gains account for 4.1°C of this lift.) Summertime indoor air temperatures do not exceed ambient temperatures by more than 0.6°C on sunny days. The Pavilion thermal performance for the spring heating season is summarized.

38797 (CONF-820940—, pp 301-310) **Passive cooling for hot arid regions.** Kessler, H.J. (Univ. of Arizona, Tucson). Nov 1982. NTIS, PC A16/MF A01. Contract AC03-80SF10816.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

A Passive Cooling Experimental Facility for a Hot/Arid Climate has been constructed. It has been designed to test a large number of passive cooling strategies in order to bring the state of the art of passive cooling up to that of passive solar heating. Three test structures and a data acquisition building have been built and are fully instrumented. Ambient weather conditions are also monitored. Passive cooling strategies being studied include both traditional and new concepts and are based on the basic passive sources of coolth: ventilation, evaporation, nocturnal radiation and earth contact.

38798 (CONF-820940—, pp 324-329) **Iowa-project passive: a program to accelerate passive solar construction in Iowa.** Svanoe, P.H. (Iowa Energy Policy Council, Des Moines). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

A program of the Iowa Energy Policy Council (state energy office) to introduce passive solar technology into community college building trades curricula is described. The center of this program is a passive solar house design which has been built in four community colleges in Iowa in lieu of a more typical design. A description of the energy related features and preliminary data pertaining to performance of the passive solar house is presented. Also described are additional aspects of this program which include development of curriculum material and outreach programs to home building industry professionals throughout Iowa.

38799 (CONF-820940—, pp 330-338) **REPEAT facility status report, September 1982.** Swartz, D.; Hancock, E.; Armstrong, P.; Winn, C.B. (Colorado State Univ., Fort Collins). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The current status and plans for the immediate future for the REPEAT facility are summarized. Progress is reported on the following: building, instrumentation, data acquisition system and infiltration. (MHR)

38800 (CONF-820940—, pp 339-345) **Performance of the RPI Passive Solar Visitors Information Center building: progress report.** Tichy, J.A. (Rensselaer Polytechnic Inst., Troy, NY). Nov 1982. NTIS, PC A16/MF A01. Contract FC02-80CS30350.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The performance evaluation of the RPI Passive Solar Visitors Information Center is proceeding smoothly. Data for January through June 1982 have been presented and extrapolated for the full year. The projected yearly total energy use is 59.6 MW-h/y (202 MBtu/y), or on a per unit floor area basis, 123 kW-h/$m^2$-y (38.7 kBtu/$ft^3$-y). These figures agree reasonably well with updated simulation provided realistic values for the interior thermostat set points are used.

38801 (CONF-820940—, pp 346-360) **Drain-down freeze protection for thermosyphon solar water heaters.** Whitehouse, H.T. Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The thermal mechanisms of collector freezing are discussed and a simple extension of active drain-down freeze protection technology is described which can be applied to passive or thermosyphon systems. (MHR)

38802 (DOE/CS/30228—T1) **Performance evaluation of the New Mexico State University passive-solar house. Final report.** Mancini, T.R. (New Mexico State Univ., Las Cruces (USA). Dept. of Mechanical Engineering). Jun 1983. Contract AC03-80CS30228. 171p. NTIS, PC A08/MF A01. Order Number DE83012741.

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The New Mexico State University Passive Solar Test Facility is a roof-pond solar house in which the collection and rejection of energy from the interior space is controlled by movable insulating panels. The results of 1981 and 1982 cooling season tests are presented in this report. The specific objectives of this project were to evaluate the effects of deflated air cells over the water bags; changing the water depth in the bags from 7.5 to 15 cm (3 to 6 inches); evaporative enhancement of the heat rejection from the bags; and the panel movement control on the performance of the system. The variation in performance due to changes in these four parameters was to be evaluated in the cooling mode of operation only. The results of the tests designed to evaluate these parameters are reported. A Master Thesis and a data are appended.

38803 (DOE/CS/30363—T1) **DOE/SERI Solar-Passive-Hybrid Manufactured-Buildings Program. Final report.** (Acorn Structures, Inc., Concord, MA (USA)). Oct 1982. Contract FC02-80CS30363. 55p. NTIS, PC A04/MF A01. Order Number DE83013386.

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A series of four passive solar houses termed the Independence Series were designed and developed with similar floor plans and sizes ranging from 1400 to 1900 square feet. Drawings and photographs are shown. The first section of this report details the marketing activities that were conducted. Cost projections and results of performance monitoring are presented.

38804 (IFU-B—08-81) **Evaluation of measurement results of the test of the solar absorption-type refrigerator machine in Split.** Podesser, E. (Institut fuer Weltraumforschung, Graz (Austria)). 1981. 103p. (In German). Institut fuer Umweltforschung, Graz, Austria.

The development of a solar refrigerator machine is reported. The plant has been installed in Split, Jugoslavia. During a performance testing the total functioning, the performance of control systems, and the fully-automatic operation had been checked.

38805 (LA—9786-MS) **National Bureau of Standards direct-gain test cell site handbook.** (Los Alamos National Lab., NM (USA)). Jun 1983. Contract W-7405-ENG-36. 41p. NTIS, PC A03/MF A01. Order Number DE83014079.

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The Passive Test Building at the National Bureau of Standards (NBS) in Gaithersburg, Maryland, is being used to collect performance data for analysis/design tool validation as part of the DOE Passive Solar Class A Performance Evaluation Program. This site handbook describes the construction, instrumentation, and test configuration of the direct-gain test cell portion of the NBS Passive Test Building for use by passive solar analysis/design tool developers and researchers.

38806 (NP—3902158) **Operation and performance of four solar domestic hot-water systems.** (Buchan, Lawton, Parent Ltd., Ottawa, Ontario (Canada)). Mar 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83902156.

In 1978 the Ontario Ministry of Municipal Affairs and Housing, with funds provided by the Ministry of Energy installed four package solar domestic hot water preheat systems in four Ontario Housing Corporation houses as part of the Housing and Energy Management Program (HEMP). The units chosen included two Grumman Energy Systems Incorporated systems and two American Heliothermal Corporation Systems designed for domestic hot water heating. Monitoring equipment was supplied and installed by the Ontario Research Foundation. This report details the monitoring program undertaken to evaluate these units, the problems encountered during the evaluation period and the performance of the systems. The report details activities from September 1979 to March 1982.

38807 (SAN—20110-9) **Exergy analysis of solar Rankine power cycles used for cooling.** Lior, N.: Subbiah, S.; Brady, W.J. III. (Pennsylvania Univ., Philadelphia (USA). Dept. of Mechanical Engineering and Applied Mechanics). 1983. Contract AC03-78ET20110. 6p. (CONF-830622—17). NTIS, PC A02/MF A01. Order Number DE83011834.

From American Solar Energy Society meeting; Minneapolis, MN, USA (1 Jun 1983).

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Second-law (exergy) analysis was performed on two types of solar-cooling systems which are based on a vapor-compression cycle driven by a Rankine cycle: those energized by the sun at one temperature and using organic fluids in the power cycle, and a hybrid cycle which is energized by a solar source at a low temperature and by a fossil source at a higher temperature and using steam as the fluid. Some of the major conclusions are: (1) A better thermodynamic match is obtained between the energy sources and sinks in the hybrid cycle, which results in a doubling of the cycle's efficiency as compared to the single-temperature organic-fluid cycle. Nevertheless, there still exists a large difference between the temperatures of combustion (~ 1500°C) and superheated steam (~ 600°C), and thus the superheater's effectiveness is relatively low. This points to several methods of improvement, including improved heat-transfer design, and utilization of the stack gases. (2) Applying superheat by solar concentrators instead of combustion improves cycle effectiveness by about 40%, and (3) the heat exchangers to recover heat from the steam after it has been exhausted from the turbine have an important influence on energy and exergy recovery but need to be carefully optimized.

38808 **Solar-powered turbocompressor heat pump system.** Landerman, A.M.; Biancardi, F.R.; Melikian, G.; Meader, M.D.; Kepler, C.E.; Anderson, T.J.; Sitler, J.W. US Patent Application 6-407,539. 12 Aug 1982. 32p. Contract AC03-77CS34510.

The turbocompressor comprises a power turbine and a compressor turbine having respective rotors and on a common shaft, rotatably supported by bearings. A first working fluid is supplied by a power loop and is expanded in the turbine. A second working fluid is compressed in the turbine and is circulated in a heat pump loop. A lubricant is mixed with the second working fluid but is excluded from the first working fluid. The bearings are cooled and lubricated by a system which circulates the second working fluid and the intermixed lubricant through the bearings. Such system includes a pump, a thermostatic expansion valve for expanding the working fluid into the space between the bearings, and a return conduit system for withdrawing the expanded working fluid after it passes through the bearings and for returning the working fluid to the

evaporator. A shaft seal excludes the lubricant from the power turbine. The power loop includes a float operable by liquid working fluid in the condenser for controlling a recirculation valve so as to maintain a minimum liquid level in the condenser, while causing a feed pump to pump most of the working fluid into the vapor generator. The heat pump compressor loop includes a float in the condenser for operating and expansion valve to maintain a minimum liquid working fluid level in the condenser while causing most of the working fluid to be expanded into the evaporator.

### 1410 Solar Collectors And Concentrators

*REFER ALSO TO CITATION(S) 38608, 38752*

**38809 (DOE/CS/15072—T4) Adjustable focus concentrating (AFC) collector system. Quarterly progress report, first quarter 1983.** Dame, R.E. (Mega Engineering Div., Silver Spring, MD (USA)). 31 May 1983. Contract FG01-81CS15072. 11p. NTIS, PC A02/MF A01. Order Number DE83012936.

Portions are illegible in microfiche products; CAPE 2827, available from Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

The present invention is a device which develops an accurate line focus concentrating collector by flexural bending of thin reflective materials. This method avoids the need for expensive tooling and support frame fabrication. The present grant was intended to commercialize this device for the solar line focus industry. As part of that effort a series of commercial plans and clients were approached to install prototype systems. The first prototype system was to be installed at the Copper Mountain Ski Resort in Colorado. Present efforts are being directed toward seeking alternate prototype sites as well as other sources of funding for the initial prototype installation. The technical work conducted during this quarter included completion of designs for the Copper Mountain system, evaluation of alternate tracking and drive systems and final design of the support system. Details of each task are outlined in the sections of this report. For clarity, this progress report has been divided into the following parts: Part 1, Technical Progress Report; Part 2, Management Progress and Commercialization; and Part 3, Cost and Contractual Status. Reference CAPE-2827.

**38810 (N—8314695) Swing to concentrator arrays.** Miller, J.L. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Jun 1982. 6p. (CONF-8205183—). NTIS, PC A15/MF A01.

From 3. European symposium on photovoltaic generators in space; Bath, UK (4 May 1982).

In Photovoltaic generators in space, p xix-xxiv (SEE N83-14694).

Objectives and progress in both low concentration ratio (6 to 10) and high concentration ratio ( 100) array developments are summarized. Problems encountered include: thermal control, maldistribution of concentrated sunlight, current busing, and optical surface degradation. The potential advantages over planar arrays are an order of magnitude reduction in per unit cost of power plus increased immunity to radiation damage.

**38811 (SLAC-PUB—3023) More on design of linear solar-energy collectors having spherical reflectors.** Hall, F.F. (Stanford Linear Accelerator Center, CA (USA)). Nov 1982. Contract AC03-76SF00515. 16p. NTIS MF A01. Order Number DE83012953.

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A number of design refinements for the basic system were discussed at MICAES IV. Net effect was increased operating temperature and concentration factors at the expense of solar energy collection efficiency. This paper discusses revisions needed to effect a more balanced overall system performance. Some items result in subsystem improvements. Notably the collection probe diameter is increased so as to obviate need for auxiliary support cables. The larger probe diameter also permits the adoption of a simpler and lighter weight probe construction system. The overall effect of lower concentration factors is reviewed. For thermal systems the heat collected per unit of collection area will be increased at lower collection temperatures. Happily, it is possible to use lower temperature and/or pressure steam turbine-generator sets having reasonably good engine efficiencies. For photo-electric applications the power flux can be much less, which is beneficial. Each of the revisions is described in some detail. An updated set of design parameters is appended.

**38812 High performance solar energy collector.** Winston, R. (Univ. of Chicago, IL); O'Gallagher, J.J.; Snail, K.; Peek, S.C. pp 445-450 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). (CONF-821121—). Contract AC04-81AL16223;AC02-80ER10558.

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

A substantial improvement in performance for stationary evacuated tube solar collectors has been achieved by integrating a nonimaging Compound Parabolic Concentrator (CPC) reflector surface into the outer glass vacuum envelope. We describe the interim results from an extended period of operational testing of a 2 $m^2$ panel of such tubes.

**38813 Solar pond research and development.** Tabor, H. (Scientific Research Foundation, Jerusalem, Israel); Schweitzer, S.; Sargent, S. pp 492-499 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon press (1982). (CONF-821121—).

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

Non-convecting solar ponds represent a method of collecting solar energy on a large scale, at temperatures of 90°C or even higher. Solar radiation penetrating a layer of water about 1 m deep heats the lower water, which does not rise because convection is suppressed by having an adequate density gradient in the pond. Two approaches to effecting such a density gradient, known as the saturated pond and the concentration gradient pond are described, the latter having been brought to practical realization. This paper describes the theory of such ponds, the Israeli experience leading to a 150 kW(e) operating pond power plant and a 5 MW(e) plant under construction, and the Australian experience. In addition, pond research and development efforts in the United States are described, based primarily upon status reports presented at the US Department of Energy (DOE) Solar Pond Research Seminar held in Washington, DC, in April 1982. Given the current climate of significantly reduced government funding for solar energy research and development (R and D), close cooperation and coordination between solar pond researchers will be crucial.

### 1420 Heat Storage

*REFER ALSO TO CITATION(S) 39035*

## 15 GEOTHERMAL ENERGY

### 1501 Resource Status And Assessment

*REFER ALSO TO CITATION(S) 38815, 38820, 38837*

**38814 (DOE/ID/12079—88) Tables of co-located geothermal-resource sites and BLM Wilderness Study Areas.** Foley, D.; Dorscher, M. (Utah Univ., Salt Lake City (USA). Earth Science Lab.). Nov 1982. Contract AC07-79ID12079. 168p. (ESL—107). NTIS, PC A08/MF A01. Order Number DE83013439.

Matched pairs of known geothermal wells and springs with BLM proposed Wilderness Study Areas (WSAs) were identified by inspection of WSA and Geothermal resource maps for the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. A total of 3952 matches, for geothermal sites within 25 miles of a WSA, were identified. Of these, only 71 (1.8%) of the geothermal sites are within one mile of a WSA, and only an additional 100 (2.5%) are within

one to three miles. Approximately three-fourths of the matches are at distances greater than ten miles. Only 12 of the geothermal sites within one mile of a WSA have surface temperatures reported above 50°C. It thus appears that the geothermal potential of WSAs overall is minimal, but that evaluation of geothermal resources should be considered in more detail for some areas prior to their designation as Wilderness.

## 1502 Geology And Hydrology Of Geothermal Systems

*REFER ALSO TO CITATION(S) 38830, 38839*

38815 (LA—9697-C, pp 28-37) **Geothermal energy in the eastern United States: the radiogenic model.** Costain, J.K.; Glover, L. III. (Virginia Polytechnic Inst., Blacksburg). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

For stable eastern regions, several geological settings that seem promising for hot-dry-rocks systems are cited. Geothermal resources in the Appalachian Mountain System and the Atlantic Coastal Plain may be grouped into: (I) water saturated sediments of low thermal conductivity overlying radioactive heat; (II) areas of normal geothermal gradient; (III) hot and warm springs emanating from fault-fracture zones as a result of lakage from greater depths; (IV) hot dry rock especially radioactive granites beneath sediments of low thermal conductivity. Each type is described and its potential is discussed. (MHR)

38816 (LA—9697-C, pp 82-85) **Geothermal exploration in the Rhine graben (West Germany and France).** Hoffers, B. (Los Alamos National Lab., NM). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

Some facts on geology and geophysics of the Rhine graben are summarized as a background to the geothermal exploration in the area.

38817 (LBL—14896) **Seismological studies at the Cerro Prieto field: 1978-1982.** Majer, E.L.; McEvilly, T.V. (California Univ., Berkeley (USA)). Oct 1982. Contract AC03-76SF00098. 8p. (CONF-8208109—7; CERRO-PRIETO—24). NTIS, PC A02/MF A01. Order Number DE83013844.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

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Varied seismological studies have been conducted to determine the static and dynamic properties of the Cerro Prieto geothermal field. Sought have been the relation of wave propagation characteristics and microearthquake activity to such features as production boundaries, recharge zones, heat sources, fluid strata, lithology and structure. Discussed here will be the results of the studies carried out by UCB-LBL since 1978 in light of the current knowledge of the Cerro Prieto field. Also included will be the interpretation of the reflection surveys carried out in the immediate production areas.

38818 (N—8315965) **The geothermal research program of the US Geological Survey.** (Geological Survey, Washington, DC (USA)). 1982. 18p. (USGS-CIRC—862). NTIS, PC A02/MF A01.

The history of the geothermal research program of the U.S. geological survey is presented.

38819 (SAND—83-0238) **Implementation of two geologic constitutive models in the HONDO finite-element code.** Swenson, D.V. (Sandia National Labs., Albuquerque, NM (USA)). May 1983. Contract AC04-76DP00789. 30p. NTIS, PC A03/MF A01. Order Number DE83013529.

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Two constitutive models for use with geologic materials have been incorporated into the HONDO finite-element program. Both models have the same behavior in tension, using a stress criterion to form cracks normal to the maximum principal stress. In compression, the two models give upper and lower bound solutions to the unconfined postfailure strength. The first model uses a Coulomb criterion to form explicit shear cracks, while the second model uses an elastic-plastic formulation developed by Krieg. Two sample applications, an indentor test and fracture of a borehole, are presented.

38820 (USGS-OFR—78-1009) **Geology and geothermal resources of the Rexburg Area, eastern Idaho.** Prostka, H.J.; Embree, G.F. (Geological Survey, Denver, CO (USA)). 1978. 51p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

A brief description of major Cenozoic geologic features of the Rexburg area and a discussion of their geothermal significance are presented. The study area, identified as having geothermal potential, is approximately circular, about 55 km across, and centered on the town of Rexburg. It is roughly coextensive with a complex of about eight calderas of Pliocene age, here named the Rexburg caldera complex. These calderas were the source of several major rhyolitic volcanic deposits present along the southeast margin of the eastern Snake River Plain. The geology of this area was previously mapped in reconnaissance (Prostka and Hackman, 1974) and much of it as remapped in detail in 1977 because of its recognized geothermal potential.

38821 (USGS-PP—1044-A) **Hydrothermal system of Long Valley caldera, California.** Sorey, M.L.; Lewis, R.E.; Olmsted, F.H. (Geological Survey, Sacramento, CA (USA)). 1978. 79p. GPO.

The geologic and hydrologic setting of the hydrothermal system are described. The geochemical and thermal characteristics of the system are presented. A mathematical model of the Long Valley caldera is analyzed. (MHR)

38822 (USGS-PP—1044-D) **Numerical modeling of liquid geothermal systems.** Sorey, M.L. (Geological Survey, Washington, DC (USA)). 1978. 30p. GPO.

A mathematical model describing the physical behavior of hot-water geothermal systems is presented. The model consists of a set of coupled partial differential equations for heat and mass transfer in porous media and an equation of state relating fluid density to temperature and pressure. The equations are solved numerically using an integrated finite difference method which can treat arbitrary nodal configurations in one, two, or three dimensions. The model is used to analyze cellular convection in permeable rock layers heated from below. Results for cases with constant fluid and rock properties are in good agreement with numerical and experimental results from other authors.

38823 (USGS-WSP—2060) **Simulation analysis of the unconfined aquifer, Raft River Geothermal Area, Idaho-Utah.** Nichols, W.D. (Department of the Interior, Washington, DC (USA); Geological Survey, Washington, DC (USA)). 1979. 50p. GPO.

This study covers about 1000 $mi^2$ (2600 $km^2$) of the southern Raft River drainage basin in south-central Idaho and northwest Utah. The main area of interest, approximately 200 $mi^2$ (520 $km^2$) of semiarid agricultural and rangeland in the southern Raft River Valley that includes the known Geothermal Resource Area near Bridge, Idaho, was modelled numerically to evaluate the hydrodynamics of the unconfined aquifer. Computed and estimated transmissivity values range from 1200 feet squared per day (110 meters squared per day) to 73,500 feet squared per day (6830 meters squared per day). Water budgets, including ground-water recharge and discharge for approximate equilibrium conditions, have been computed by several previous investigators; their estimates of available ground-water recharge range from about 46,000 acre-feet per year (57 cubic hectometers per year) to 100,000 acre-feet per year (123 cubic hectometers per year). Simulation modeling of equilibrium conditions represented by 1952 water levels suggests: (1) recharge to the water-table aquifer is about 63,000 acre-feet per year (77 cubic hectometers per year); (2) a significant volume of ground water is discharged through evapotranspiration by phreatophytes growing on the valley bottomlands; (3) the major source of recharge may be from upward leakage of water from a deeper, con-

fined reservoir; and (4) the aquifer transmissivity probably does not exceed about 12,000 feet squared per day (3100 meters squared per day). Additional analysis carried out by simulating transient conditions from 1952 to 1965 strongly suggests that aquifer transmissivity does not exceed about 7700 feet squared per day (700 meters squared per day). The model was calibrated using slightly modified published pumpage data; it satisfactorily reproduced the historic water-level decline over the period 1952 to 1965.

38824 **Rb-Sr geochronologic investigation of precambrian samples from deep geothermal drill holes, Fenton Hill, New Mexico.** Brookins, D.G.; Laughlin, A.W. (New Mexico Univ., Albuquerque (USA). Dept. of Geology; Los Alamos National Lab., NM (USA)). *Journal of Volcanology and Geothermal Research;* **15**: No. 1-3, 43-58(Jan 1983).

Analyses of twenty-six gneissic whole rocks from the depth range 732-2588 m in drill hole GT-2 yield a 1.62+-0.04 b.y. isochron age with initial $^{86}Sr/^{88}Sr(R_0)=0.7067+-0.0014$; this age is in agreement with radiometric ages reported for rocks elsewhere in north-central New Mexico. A preliminary isochron age of 1.92+-0.18 b.y. with $R_0=7014+-0.0025$ from the nearby drill hole GT-1 is defined by eight samples. Because these samples are more representative of mineral systems or granite gneiss-amphibolite mixtures, the age is interpreted as being anomalously old. Samples of non-foliated biotite granodiorite from below 2588 m in GT-2 and from EE-2 yield an 1.50+-0.12 b.y. isochron ($R_0=0.7038+-0.0016$). Hence the biotite granodiorite may either be a sill or an apophysis of a younger pluton. Dikes of fine-grained leucocratic and biotite monzogranites, which intrude the more coarse-grained 1.62-b.y. old gneisses are dated at 1.44+-0.03 b.y. ($R_0=0.7040+-0.0009$). We thus recognize metamorphic activity at 1.62 b.y.; major magmatism at about 1.50 b.y.; and more local dike emplacement at 1.44 b.y. Present elevated in-situ temperatures have not disturbed the Rb-Sr systematics.

## 1503 Geothermal Exploration And Exploration Technology

*REFER ALSO TO CITATION(S) 38373, 38817, 38821, 39378*

38825 **(DOE/ET/28352—T1) Rapid reconnaissance of geothermal prospects using shallow temperature surveys. Second technical report.** LeSchack, L.A.; Lewis, J.E.; Chang, D.C.; Lewellen, R.I.; O'Hara, N.W. (Leschack Associates Ltd., Silver Spring, MD (USA)). Mar 1979. Contract AC01-77ET28352. 48p. NTIS, PC A03/MF A01. Order Number DE83012686.

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The previously examined geothermal sites at Long Valley and Coso were studied in much greater detail. Techniques for correcting the 2-m temperature data were evaluated. Using a preliminary model and analysis of the Coso data, the importance of measuring soil thermal diffusivity data at each temperature probe site was shown. Corrected 2-m temperature anomaly at Coso was compared with a low altitude aeromagnetic anomaly and an anomaly outlined by electrical resistivity methods obtained independently. Preliminary tests were made with a simple thermal conductivity probe demonstrating the feasibility of measuring soil thermal diffusivity at the time the 2-m temperatures are recorded. This opens the way for operational shallow temperature surveys in areas which do not have, as at Coso, a simple set of surface conditions. It is concluded that making useful shallow temperature measurements where there is a modest amount of ground water flow need not be a hopeless task.

38826 **(LA—9697-C) Workshop on exploration for hot dry rock geothermal systems.** Heiken, G.H.; Ander, M.E.; Shankland, T.J. (comps.). (Los Alamos National Lab., NM (USA)). Mar 1983. Contract W-7405-ENG-36. 89p. (CONF-8206177—). NTIS, PC A05/MF A01. Order Number DE83009627.

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

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Separate abstracts were prepared for fifteen papers. (MHR)

38827 (LA—9697-C, pp 18-21) **Hot dry rock is where you find it.** Smith, M.C. (Los Alamos National Lab., NM). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

The process of selecting hot-dry-rock sites is described. The study of published data, heat flow measurements, structural mapping, and a slim exploratory borehole to the Precambrian basement are key factors in site selection.

38828 (LA—9697-C, pp 22-27) **Heat flow: the technique for hot dry rock exploration and evaluation.** Blackwell, D.D. (Southern Methodist Univ., Dallas, TX). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

Heat flow rather than geothermal gradient must be used in HDR evaluation. Heat flow techniques are the most cost effective technique for exploring for HDR because of the specific nature of the technique, because of the extensive data base available, and because of the understanding of the controls on heat flow variations. Much new data has been developed through the DOE hydrothermal exploration programs and most of this data is directly applicable to the HDR program. Several large new areas of potential importance for HDR exploitation have been located. Many new local geothermal systems have been drilled that may be suitable for HDR exploitation as the technique is developed.

38829 (LA—9697-C, pp 38-42) **Magnetotellurics applied to hot dry rock geothermal exploration in Arizona and New Mexico.** Ander, M.E. (Los Alamos National Lab., NM). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

Five long two-dimensional profiles developed from approximately 200 magnetotelluric soundings in Arizona and New Mexico are shown. These models indicate strong evidence for a correlation between the depth to deep electrical conductor and surface heat flow as well as with regional tectonics. (MHR)

38830 (LA—9697-C, pp 43-45) **Interpretation of magnetotelluric soundings for hot dry rock prospecting.** Jiracek, G.R. (San Diego State Univ., CA). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

It is suggested that a conductive horizon occurs in the crust where an impermeable, ductile cap traps pore fluids underneath. It is likely that estimates of crustal temperature and regional heat flow can be obtained from estimates of the depth to crustal electrical conductor.

38831 (LA—9697-C, pp 46-50) **Some effects of two-and three-dimenstional structure on magnetotelluric data.** Orange, A.S. (Emerald Exploration Consultants, Austin, TX); Park, S.; Chambers, D. Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

Approaches to magnetotelluric survey planning are suggested that take into account potential interpretive problems.

38832 (LA—9697-C, pp 51-57) **Determination of depth to the Curie isotherm from aeromagnetic data.** Won, I.J.; Son, K.H. (North Carolina State Univ., Raleigh). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

Using the geometrical model and the inversion technique, aeromagnetic data of the Yellowstone Park, Wyoming was analyzed. The digitized data were first low-pass filtered at a 10-km wavelength. A total of 12 east-west profiles evenly distributed in the area were then subjected to the inversion process to derive simultaneously the depth and susceptibility profiles. The estimated Curie depth and the profiles. The estimated Curie depth and the suscepti-

bility structure for the entire area are shown. A cursory check with available surface geological map of the area shows the results are reasonably correlated with local geology. Since the results derived represent the thickness of the entire magnetized crust and its average susceptibility, it is rather difficult to compare with the available superficial geological information. The main consolation is, however, that, for the entire profiles, the rms difference between the field data and model data is mostly less than two gammas, an excellent match for the geologically complex area.

38833 (LA—9697-C, pp 58) **3-D seismic velocity anomalies in the crust and upper mantle associated with geothermal areas of the western United States.** Aki, K. (Massachusetts Inst. of Tech., Cambridge). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

38834 (LA—9697-C, pp 59-65) **Fenton Hill site selection and evaluation: a case history.** Laughlin, A.W. (Los Alamos National Lab., NM). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

This history begins with the original site selection criteria, proceeds through the compilation of existing data and collection of new data to the evaluation of methods and results and finally to the application of these results to the search for new sites. Reviewed in perspective the case history shows that the original site selection criteria were correct.

38835 (LA—9697-C, pp 66-70) **Geophysical exploration for hot dry rock in the midcontinent.** Hinze, W.J. (Purdue Univ., West Lafayette, IN); Braile, L.W.; von Frese, R.R.B.; Keller, G.R.; Roy, R.F.; Morgan, P. Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

Five generalized models of exploration targets for midcontinent HDR sites have been identified: (1) radiogenic heat sources; (2) conductivity-enhanced normal geothermal gradients; (3) residual magmatic heat; (4) sub-upper crustal sources; and (5) hydrothermal-generated thermal gradients. These models are illustrated schematically.

38836 (LA—9697-C, pp 71-72) **Seismic methods of hot dry rock exploration.** Braile, L.W. (Purdue Univ., West Lafayette, IN); Hinze, W.J.; von Frese, R.R.B.; Keller, G.R. Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

The possibilities and limitations inherent in seismic survey methods are reviewed briefly.

38837 (LA—9697-C, pp 73-74) **Geothermal anomalies in the northern Appalachian basin; western and central New York.** Hodge, D.S.; Fromm, K.A. (State Univ. of New York at Buffalo, Amherst). Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

An integrated analysis of heat flow, bottom-hole temperatures (BHT), temperature gradients, geochemical indicators and gravity has been adapted. Detailed temperature-gradient analysis indicates that higher than normal geothermal gradients exist in New York; consistent patterns of high temperature gradients for areas near Cayuga Lake, East Aurora and Elmira were identified by using bottom-hole temperatures. Initial results suggested that the regional and local variations in temperature gradients were related to vertical and lateral conductivity changes and to local changes in heat flow due to heat generation in granitic plutons in the basement; this preliminary conclusion was consistent with the interpretation of heat flow on the Atlantic coastal plain by Costain. Due to the relatively simple geology, New York State provides an ideal location for the analysis of heat flow variation and relationship of this variation to basement lithology.

38838 (LA—9697-C, pp 75-81) **Geothermal investigations in Nebraska.** Gosnold, W.D. Jr. (Univ. of Nebraska, Omaha); German, K.E. Jr. Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

Equilibrium temperature measurements were obtained in more than 100 additional wells; and this information was combined with heat flow data, thermal conductivity data, and stratigraphic data from electric logs of deep wells. These data were synthesized with the assumption that, in a conductive thermal regime, subsurface temperatures are determined by the heat flow and the thermal conductivities of the lithologic units present. The result is the identification of a low-temperature geothermal resource area of about 107,000 $km^2$ in extent that contains on the order of $1000 \times 10^{18}$ J of energy stored in the sands of the Dakota Group. One of the primary reasons for the existence of this low-temperature geothermal resource is that most of the stratigraphic section overlying the Dakota Group in Nebraska consists of shales that have thermal conductivities of around 1.1 W/m/K. Consequently the geothermal gradients within these thick (up to 2 km) shale sections are approximately 50 K/km even where the heat flow is not anomalously high.

38839 (LA—9697-C, pp 86-88) **Parametric exploration for hot dry rock.** Meidav, T. Mar 1983. NTIS, PC A05/MF A01. (CONF-8206177—).

From Workshop on exploration for hot dry rock geothermal systems; Los Alamos, NM, USA (21 Jun 1982).

The advantages and disadvantages of the following exploration techniques are described briefly: heat flow, resistivity, seismic, gravity, magnetic, and geologic survey methods. (MHR)

38840 (USGS-OFR—79-382) **Deep-drilling data, Raft River Geothermal Area, Idaho. Raft River geothermal production well No. 5.** Covington, H.R. (Geological Survey, Denver, CO (USA)). 1979. 30p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

38841 (USGS-OFR—79-540) **Chemical composition of water and gas from five nearshore subaqueous springs in Clear Lake, northern California.** Thompson, J.M.; Sims, J.D.; Yadav, S.; Rymer, M.J. (Geological Survey, Menlo Park, CA (USA)). 1979. 19p. USGS, Open File Service, Denver Federal Center, Box 25425, Denver, CO 80225.

In 1971 The Geysers-Clear Lake area was selected by the US Geological Survey geothermal research program as a region for extensive investigation. Under this program thermal water samples were first collected in December, 1974 during a winter of normal rainfall; the last samples were collected in February, 1977 during a period of drought. The drought exposed many springs which normally are submerged by Clear Lake. It was demonstrated that gas and water samples can be collected from shallow submerged springs relatively simply using a peristaltic, battery powered pump. Qualitatively sulfate, ammonia, chloride and lithium concentrations may be used to estimate the amount of lake water contamination. The gas sampling technique, using an inverted funnel and long tube to the surface only where visibility was greater than 2 to 3 m. Analyses of near surface compared to deeper submerged gas indicates air contamination in the near surface sample. Thus gas samples should be collected deep underwater or as near the spring vent or gas orifice as possible.

38842 (USGS-OFR—79-593) **In-situ determination of heat flow in unconsolidated sediments.** Sass, J.H.; Kennelly, J.P. Jr.; Wendt, W.E.; Moses, T.H. Jr.; Ziagos, J.P. (Geological Survey, Denver, CO (USA)). 1979. 79p. USGS-Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Subsurface thermal measurements are the most effective, least ambiguous tools for identifying and delineating possible geothermal resources. A technique was developed which provides reliable real-time determinations of temperature, thermal conductivity, and hence, of heat flow during the drilling operation in unconsolidated sediments. A combined temperature, gradient, and thermal conductivity experiment can be carried out, by driving a thin probe

through the bit about 1.5 meters into the formation in the time that would otherwise be required for a coring trip. Two or three such experiments over the depth range of, say, 50 to 150 meters provide a high-quality heat-flow determination at costs comparable to those associated with a standard cased gradient hole to comparable depths. The hole can be backfilled and abandoned upon cessation of drilling, thereby eliminating the need for casing, grouting, or repeated site visits.

38843 **Sampling and analysis of suspended solids in geothermal systems.** Elmore, R.P. (Pacific Northwest Lab., Richland, WA). pp 217-243 of Chemical and geochemical aspects of fossil energy extraction. Yen, T.F.; Kawahara, F.K.; Hertzberg, R. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). (CONF-800814—).

From 180. American Chemical Society meeting/2. chemical congress of the North American Continent; Las Vegas, NV, USA (24 Aug 1980).

The technique considered to have the most potential for disposal of spent geothermal fluids is reinjection of the brine into subsurface formations. Suspended solids (SS) have been reported to cause well and formation plugging; thus SS are a major parameter requiring careful monitoring. All major sampling and analytical techniques, plus a few newly developed ones, will be compared in actual field conditions as to their reliability to determine the size distribution and total suspended solids (TSS) in geothermal fluids. Methods compared are: single-filter weight gain; multiple-filter weight gain; inline counting by light scattering through a window or by a group samples; and multiple-filter weight gain under actual temperature and pressure conditions inline. The chemistry of the suspended solids also was studied. At the East Mesa KGRA, the finest particle distributions (<0.22 μm) were sulfides and the larger particles were silicates (>5.0 μm). The change in size distributions and chemical compositions of the suspended particles as the fluid progressed through a geothermal power plant also will be presented.

## 1504 Legal And Institutional Aspects

38844 **(GE—3114-T2) Statistical characterization of the federal geothermal leasing and permitting program. Final report, April 18, 1978-January 31, 1979.** Beeland, G.V.; Ludington, J.A.; Schumann, E. (Wapora, Inc., Chevy Chase, MD (USA)). Jan 1979. Contract AC01-78ET27189. 91p. NTIS, PC A05/MF A01. Order Number DE83013447.

The ineffectiveness thus far in the federal geothermal leasing program is documented. Leases have been issued on only 18% of non-competitive applications on land under BLM jurisdiction and 2% of applied-for National Forest land. It has taken an average of about two years to get a lease, although the time lapses involved are extremely erratic, and many applications have been pending since January 1974, the first month applications were accepted. Some gradual improvement in BLM performance was demonstrated, however. Only about 250 competitive leases have been issued on the 50% of BLM acreage and the 2% of KGRA acreage in National Forests which has been offered. The US Geological Survey postlease permitting performance is also non-uniform in timeframes required for approvals. To some extent, this has resulted from stated lessee priority.

## 1506 Environmental Aspects And Waste Disposal

*REFER ALSO TO CITATION(S) 38843*

## 1508 Geothermal Power Plants

*REFER ALSO TO CITATION(S) 38872*

## 1509 Geothermal Engineering

38845 **(BNL—33081) Cathodic protection in simulated geothermal environments.** Bandy, R.; van Rooyen, D. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 26p. (CONF-830144—1). NTIS, PC A03/MF A01. Order Number DE83013690.

From National Association of Corrosion Engineers meeting; San Francisco, CA, USA (17 Jan 1983).

The results of cathodic protection of carbon steel and AISI Type 316 stainless steel in simulated geothermal brines are described. Impressed current tests on carbon steel and stainless steel were conducted under controlled potential, and cathodic protection of carbon steel using zinc sacrificial anodes was studied by monitoring the galvanic current and potential of the couple with a zero-resistance ammeter. Weight-loss measurements and photomicrographs of test coupons were taken whenever necessary to determine the nature of attack and degree of protection. Tests were generally conducted at 90°C. However, some tests on carbon steel were conducted up to 150°C in a titanium autoclave. Results show that the weight loss of carbon steel can be reduced significantly and the pitting corrosion of the stainless steel can be prevented by shifting the potentials of the metals 60 to 80 mV cathodic to their respective open-circuit potentials.

38846 **(BNL—33127) High-temperature cementing materials for completion of geothermal wells. Final report.** Kalyoncu, R.S.; Snyder, M.J. (Battelle Columbus Labs., OH (USA)). May 1981. Contract AC02-76CH00016. 58p. NTIS, PC A04/MF A01. Order Number DE83013691.

Several portland cement types, oil well cements, and various additives and admixtures were evaluated during the course of development of a number of promising compositions suitable for geothermal applications. Among the cements and various materials considered were portland cement Types I, III, and V; oil well cement Classes G, H, and J; and additives such as silica flour, blast furnace slags, pozzolan, hydrated lime, perlite, and aluminum phosphate. Properties of interest in the study were thickening time, compressive strength, cement-to-metal bond strength, and effects of the cements on the corrosion of steel well casings. Testing procedures and property data obtained on a number of compositions are presented and discussed. Several cementing compositions comprised of Class J oil well cement, pozzolan, blast furnace slags, and silica flour were found to possess properties which appear to make them suitable for use in geothermal well completions. Five of the promising cementing compositions have been submitted to the National Bureau of Standards for additional testing.

38847 **(BNL—33128) Short and long-term tests of elastomers with hot hostile fluids. Environmental Compatibility Test Program final report.** Friese, G.J. (L'Garde, Inc., Newport Beach, CA (USA)). 30 Dec 1982. Contract AC02-76CH00016. 191p. NTIS, PC A09/MF A01. Order Number DE83013692.

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Equipment manufacturers and elastomer houses were called to find the best currently available high-temperature elastomers. Tensile specimens of 46 such compounds were immersion tested for five days in six 190C fluids of interest: isobutane, brine, ASTM No. 1 oil, ASTM No. 3 oil, Pacer DHT-185M synthetic oil, and Chevron Cylinder Grade 460X oil. The best eight were selected based upon the least change in mechanical properties. These eight were then simultaneously tested (a) by immersion in five 190C fluids for six months and (b) as 0-rings for 46 hours at 190C, 230C, and 265C (accelerated ageing) in three fluids and at a differential pressure of 21 MPa. Based upon these 0-ring tests, four compounds were selected for testing as 0-rings in three 204C fluids at 21 MPa differential pressure. The data were evaluated and conclusions were drawn. Conclusions and recommendations are provided. There was immersion testing of primarily L'Garde compounds in brine and CL3 mineral oil for 6 months at 190C. L'Garde had formulated several compounds specifically for 260C brine, and their applicability to a specific problem was assessed early in the program.

38848 **(BNL—33131) Feasibility study to evaluate the effects of cavitation mixing upon the pumpability and strength characteristics of cements for geothermal applications. Final report.** Stansfield, T.J. (Daedalean Associates, Inc., Woodbine, MD (USA)). May 1982. Contract AC02-76CH00016. 74p. NTIS, PC A04/MF A01. Order Number DE83013688.

Two on-line emulsification techniques were evaluated as potential systems for preparation of geothermal cement. The objective of the program was met through the demonstrated feasibility and enhanced material properties by cavitation emulsification of geothermal cements. A standard mixing technique for preparing two types of geothermal cements, a lightweight and a heavyweight, was supplemented in a laboratory environment using either of two cavitation mixing techniques. The density and viscosity of the respective slurries and the compressive strength of the corresponding set cements, which were cured at elevated temperature and pressure, were measured to compare the effects of the supplemental techniques with that produced by the established method alone. The test results indicated an enhanced improvement in the compressive strength of the lightweight emulsified cement. The lightweight emulsified cement also showed an increase in the room temperature density. The room temperature viscocity of the emulsified lightweight cement was initially improved. The emulsification of the heavyweight cement had little effect on the material properties.

38849 **(DOE/AL/10563—T17) Laboratory study of acid stimulation of drilling-mud-damaged geothermal-reservoir materials. Final report.** (Terra Tek, Inc., Salt Lake City, UT (USA)). May 1983. Contract AC04-79AL10563. 49p. NTIS, PC A03/MF A01. Order Number DE83011297.

Presented here are the results of laboratory testing performed to provide site specific information in support of geothermal reservoir acidizing programs. The testing program included laboratory tests performed to determine the effectiveness of acid treatments in restoring permeability of geologic materials infiltrated with hydrothermally altered sepiolite drilling mud. Additionally, autoclave tests were performed to determine the degree of hydrothermal alteration and effects of acid digestion on drilling muds and drill cuttings from two KGRA's. Four laboratory scale permeability/acidizing tests were conducted on specimens prepared from drill cuttings taken from two geothermal formations. Two tests were performed on material from the East Mesa KGRA Well No. 78-30, from a depth of approximately 5500 feet, and two tests were performed on material from the Roosevelt KGRA Well No. 52-21, from depths of approximately 7000 to 7500 feet. Tests were performed at simulated in situ geothermal conditions of temperature and pressure.

38850 **(DOE/CH/00016—T2) Elevated-temperature fracture toughness and fatigue testing of steels for geothermal applications. Annual progress report.** Cutler, R.A.; Goodman, E.C.; Guest, R.V.; Hendrickson, R.R.; Leslie, W.C. (Terra Tek, Inc., Salt Lake City, UT (USA)). Nov 1980. Contract AC02-76CH00016. 94p. NTIS, PC A05/MF A01. Order Number DE83013874.

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Conventional drill bit steels exhibit increased wear and decreased toughness when run at elevated temperatures in geothermal wells. Bits are therefore run at lower speeds and lighter loads, resulting in lower penetration rates for geothermal wells than for conventional rock drilling. Carpenter EX-00053, Timken CBS 600, Timken CBS 1000M and Vasco X-2M, steels with improved hot hardness (improved wear resistance), were tested in conjunction with the steels used for cones (AISI 4820 and 9315) and lugs (AISI 8620 and 9315) in conventional roller cone rock bits. Shortrod fracture toughness measurements were made on each of these steels between room temperature and 400°C. Fatigue crack resistance was determined at 300°C for high-temperature steels and at room temperature for conventional steels. Scanning electron microscopy analyses of the fractured short-rod specimens were correlated with observed crack behavior from the test records. Test results are discussed, recommendations made for further testing and preliminary steel selections made for improved geothermal bits.

### 1510 Direct Energy Utilization

38851 **(DOE/ET/27059—1) Direct utilization of geothermal energy for space and water heating at Marlin, Texas. Final report.** Conover, M.F.; Green, T.F.; Keeney, R.C.; Ellis, P.F. II; Davis, R.J.; Wallace, R.C.; Blood, F.B. (Radian Corp., Austin, TX (USA)). May 1983. Contract AC08-78ET27059. 344p. NTIS, PC A15/MF A01. Order Number DE83013375.

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The Torbett-Hutchings-Smith Memorial Hospital geothermal heating project, which is one of nineteen direct-use geothermal projects funded principally by DOE, is documented. The five-year project encompassed a broad range of technical, institutional, and economic activities including: resource and environmental assessments; well drilling and completion; system design, construction, and monitoring; economic analyses; public awareness programs; materials testing; and environmental monitoring. Some of the project conclusions are that: (1) the 155°F Central Texas geothermal resource can support additional geothermal development; (2) private-sector economic incentives currently exist, especially for profit-making organizations, to develop and use this geothermal resource; (3) potential uses for this geothermal resource include water and space heating, poultry dressing, natural cheese making, fruit and vegetable dehydrating, soft-drink bottling, synthetic-rubber manufacturing, and furniture manufacturing; (4) high maintenance costs arising from the geofluid's scaling and corrosion tendencies can be avoided through proper analysis and design; (5) a production system which uses a variable-frequency drive system to control production rate is an attractive means of conserving parasitic pumping power, controlling production rate to match heating demand, conserving the geothermal resource, and minimizing environmental impacts.

## 16 TIDAL POWER

### 1608 Wave Energy Converters

38852 **Pneumatic wave energy conversion.** McCormick, M.E. (US Naval Academy, Annapolis, MD); Burcher, E.S. pp 330-336 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). (CONF-821121—).

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

Wave energy conversion using the pneumatic system is discussed. The performance of the system is shown to be optimized by both tuning to a desired wave period and impedance-matching. The desired wave period may be either that of the local swell or the period corresponding to the peak of the wave energy spectrum. Air compressibility is shown to be an important factor in the tuning process. By reducing the air volume above the oscillating water column, the natural period of the system is reduced. The turbine system found to be most suitable to the pneumatic system is the McCormick counter-rotating turbine. Since the turbine operation is unaffected by changes in flow direction, it requires no rectifying flaps or valves which are subject to fouling. Small diameter tunable systems are found to be most feasible in wind waves, while large diameter (untuned) systems are apropos in swell.

## 17 WIND ENERGY

38853 **(DOE/BP—151-Vol.2) Bonneville Power Administration comparative electric-generation study. Final report. Volume II.** (Raymond Kaiser Engineers, Inc., Oakland, CA (USA)). Jan 1983. 324p. NTIS, PC A14/MF A01. Order Number DE83012909.

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Case studies for each technology were developed based upon a set of assumptions provided by BPA regarding the technology type, site, and size of respective facilities. The case studies in-

clude estimates for capital costs, operating costs, project schedules, construction cash flow, and annual energy generation for hypothetical facilities. Data for busbar cost calculations were derived from the parameters developed in the case studies. Appendix A describes the approach to the market penetration and experience curve analysis for wind and solar technologies. As presented, the information shows the relationship between time and capital costs. Appendix B is a discussion of tax incentives. Because none of the case studies assumed third-party ownership, only normal utility tax considerations were applied. Appendix C contains the financial assumptions, such as escalation rates for labor and fuels, used in the busbar power cost program. Appendix D describes the underlying methodology of the busbar power cost computer program.

38854 **(ECN—83-008) Incorporation of electric power from wind generators. Some aspects of the control speed of the conventional electric power generating plants.** Janssen, A.J. (Stichting Energieonderzoek Centrum Nederland, Petten). Jan 1983. 32p. (In Dutch). Stichting Energieonderzoek Centrum Nederland, Petten.

A numerical model is described from which can be derived the approximate requirements on the controllability of the electric power generating system, with and without the incorporation of wind power. A few examples lead to the conclusion that incorporation on a large scale of wind energy makes the load management difficult, but does not lead to the import of electric power on a large scale.

## 1701 Availability (climatology)

38855 **(PNL—4429) Statistical analysis of tape deck 1440 data for wind resource assessment.** Zengerle, R.; Barchet, W.R. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC06-76RL01830. 113p. NTIS, PC A06/MF A01. Order Number DE83013743.

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The objective of this analysis was to produce a uniform, detailed statistical analysis of the wind resource for as many stations across the United States as possible. Careful attention was made to isolating periods of record for each station during which the anemometer height, its physical location and frequency of observation remain constant. Multiple periods of record were analyzed for many stations. Considerable use was made of the National Wind Data Index to identify these periods. This report describes in detail the method of analysis and the tabular products of the analysis. The format and content of each of the 19 different tables is described and an example is given. Where appropriate, formulas that were used to compute various statistics are given. Reference is frequently made to the computer code that was used in the analysis; a listing of the code is included as an Appendix.

## 1704 Economics

*REFER ALSO TO CITATION(S) 38612*

38856 **(DOE/ET/4053—78/1(Exec.Summ.)) Economic incentives to wind systems commercialization. Executive summary.** Lotker, M.; Shaw, R.W. Jr.; Adolfson, W.F.; Bernardi, R.P.; Davidoff, P.H.; Eckhart, M.T.; Gunwaldsen, D.S.; Mettam, P.J.; Narayanan, P.; Sillin, J.O. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Aug 1978. Contract AC01-77ET20238. 35p. NTIS, PC A03/MF A01. Order Number DE83013417.

This assessment of Economic Incentives to Wind Systems Commercialization is an analysis of the quantitative and qualitative impacts of a variety of government funded economic incentives on Wind Energy Conversion Systems (WECS). The purpose of this study is to achieve better understanding of the relationship between implementation of specific economic incentives for WECS, and the factors surrounding WECS commercial introduction.

## 1705 Environmental Aspects

*REFER ALSO TO CITATION(S) 39389*

## 1706 Wind Energy Engineering

*REFER ALSO TO CITATION(S) 38742*

38857 **(DOE/ARS—7315-20741/83/1) Evaluation of pumps for wind-driven irrigation. Final report.** Marjon, P.L.; Clark, R.N. (Science Applications, Inc., Albuquerque, NM (USA). Alternate Energy Systems Div.; Department of Agriculture, Bushland, TX (USA)). Nov 1982. Contract AI01-76ET20319. 174p. NTIS, PC A08/MF A01. Order Number DE83013438.

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The report contains a survey of a variety of pumping equipment that can be used for wind power irrigation applications. Data are developed and sample results are presented on the economics of wind driven irrigation pumps as compared with other types of energy source-irrigation pump contributions. Conclusions are presented on the economics of wind driven irrigation pumps and suggestions are given for improving the economic potential.

38858 **(DSE—23052-81/1) Energy from humid air. Final report.** Oliver, T.K.; Groves, W.N.; Gruber, C.L. (South Dakota School of Mines and Technology, Rapid City (USA)). Jan 1982. Contract AC01-79ET23052. 109p. NTIS, PC A06/MF A01. Order Number DE83012391.

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A mathematical model was derived for the vortex flow, dividing the vortex into inner and outer regions. Equations were written for each region and computer solutions have been obtained. Viscous losses assuming laminar flow and losses to turbulence were studied. A machine was then designed for extraction of kinetic energy from humid air using a vortex. Related investigations on condensation dynamics and cooling dynamics are reported. (LEW)

38859 **(ECN—82-178) Testing of the Lagerwey-v.d. Loenhorst type 24/10 wind turbine at the ECN testfield. Testing program and measuring methods.** Stam, W.J.; Ramakers, S.G. (Stichting Energieonderzoek Centrum Nederland, Petten). Dec 1982. 29p. (In Dutch). Stichting Energieonderzoek Centrum Nederland, Petten.

A description is given of the testing program of a Lagerwey-v.d. Loenhorst wind turbine at the ECN testfield. The measuring methods are described.

38860 **(ECN—82-188) Lightning damage of the 25 m horizontal axis wind turbine.** Looijesteijn, C.J.; Terwisscha van Scheltinga, T.H. (Stichting Energieonderzoek Centrum Nederland, Petten). Dec 1982. 34p. (In Dutch). Stichting Energieonderzoek Centrum Nederland, Petten.

At the end of November 1982 a lightning struck the measuring instruments and data acquisition systems near a horizontal axis wind turbine. Reported here are the damage at the installation due to the lightning and measures taken to protect the system in the future.

38861 **(ECN—83-019) WEPP - A general program for the calculation of electric power generated by wind turbines.** Oei, T.D.; Curvers, A. (Stichting Energieonderzoek Centrum Nederland, Petten). 1983. 42p. (In Dutch). Stichting Energieonderzoek Centrum Nederland, Petten.

The application of desk top calculators offers the possibility of leading calculating the generation factor of wind turbines in a uniform and objective manner. The program WEPP has been written in Basic for an Apple Plus computer. The program is written in such a manner that different parameters can be considered. Some examples are given.

**38862 (PNL—4231) Statistical analysis of wind characteristics at candidate wind-turbine sites.** Corotis, R.B. (Johns Hopkins Univ., Baltimore, MD (USA)). Aug 1982. Contract AC06-76RL01830. 47p. NTIS, PC A03/MF A01. Order Number DE83013742.

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Accurate prediction for a wind turbine facility performance is dependent on appropriate wind characteristics data. This report presents preliminary recommendations of appropriate data recording procedures for initial site evaluation and for large machine performance evaluation. Conclusions are based on autocorrelation, autospectrum persistence, cross-correlation, and coherence analysis of a limited sample of wind speed and turbine power data collected at the MOD-OA 200 kw wind turbine generator site at Clayton, New Mexico. For preliminary site assessment, this study shows that data should be gathered from two heights on a meteorological tower. One height should approximate the elevation of the turbine hub. A second reference height, e.g. 10 m, would be useful for comparisons among different sites. For site selection, these data should be short-term averages. For instance, 15-second average wind speeds correlate well with turbine performance, and 1-minute average wind speeds provide a comparison to other sites with only National Weather Service (NWS) data. Once a turbine is installed, it is desirable to collect additional data for machine performance evaluation. A sampling rate of once every 10 minutes is suggested, with the following five pieces of data recorded: a single 1-second average wind speed, a single 15-second average wind speed, a single 1-minute average wind speed, a full 10-minute average wind speed, and the variance of all 15-second averages within the 10-minute sampling interval. These data provide extensive information for blade stress analysis, turbine performance and comparison to NWS sites. Wind speed data from the nacelle anemometer of an operating turbine exhibit relatively high correlation with turbine power that is independent of averaging times under a minute, so shorter averages may be omitted if only power comparisons are desired.

**38863 (PNL-SA—10994) Simulating large turbine operations and the effects of wind characteristics of energy capture.** Miller, A.H.; Formica, W.J. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 11p. (CONF-830631—8). NTIS, PC A02/MF A01. Order Number DE83013836.

From 6. biennial wind energy conference; Minneapolis, MN, USA (1 Jun 1983).

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Statistical models of wind power for energy capture calculations are typically used as a design criteria for wind turbines. In the case of relatively small turbines, the assumption that an annual distribution of hourly wind speeds can be used to estimate annual energy capture is reasonably valid. For larger, megawatt-sized turbines, that assumption becomes less valid based on a number of parameters associated with both the turbine design and the characteristics of the wind at a given site. In recent work, serious efforts have been made to develop, test and verify computer models or simultations of current large horizontal-axis wind turbines. These models actually simulate the overall operations of the turbines by emulating the operating strategy of the turbine in concert with the wind-to-power curve. A model of the MOD-OA has been developed and validated with data from the Clayton, New Mexico, test site. A model of the MOD-2 turbine has also been developed, tested and validated using concurrent wind and turbine data from the Goodnoe Hills, Washington, turbine site. As a result of this work, the effect of the non-steady characteristics of the wind for the various states of the atmosphere and the apparent effect of topography have evidenced their effect on energy capture by large wind turbines. The use of such models in advance of the final design process for future generation turbines is demonstrated and shown to be particularly useful in the decision-making process by the engineer and also in the design of the site-specific operating strategy.

**38864 (PNL-SA—10999) Status of wind-turbine wakes research in the Federal Wind-Energy Program.** Hadley, D.L.; Renne, D.S. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 22p. (CONF-830622—16). NTIS, PC A02/MF A01. Order Number DE83013828.

From American Solar Energy Society meeting; Minneapolis, MN, USA (1 Jun 1983).

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The MOD-2 cluster at Goodnoe Hills, Washington, provides a unique test facility for conducting research on the performance of operating large multi-megawatt-size wind turbines. During the summer of 1982 a series of wake studies were conducted at Goodnoe Hills, sponsored by the Department of Energy's Wing Energy Technology Division. These studies represent the first in a series of field experiments designed to assess the impact of wind turbine wakes on downwind machines operating in clusters or arrays. Based on the results of the field measurement programs at Goodnoe Hills, a much better understanding of the instantaneous structure of a wake in the near-wake region behind a large wind turbine, and of the distribution of the wake-induced velocity deficits out to 10 diameters downwind of a single machine is evolving. A clearer picture of the qualitative nature of the turbulence structure of the wake, and of the characteristics of the vortices induced by the tips of the rotating blade has developed. The complex terrain and resultant complex airflow over the site plays an important role in the downwind structure and re-energizing of the wake that needs to be accounted for in future experiments. A major goal of the Federal Wind Energy Program's wake measurement program is to provide an adequate data base for verifying or improving upon existing numerical models of the wake phenomenon or of array performance. To achieve this, future experiments need to initially concentrate on sites where the surrounding terrain plays an insignificant role in determining the character of the wake, and where large arrays of well-instrumented machines are operating to obtain multiple machine interaction data.

**38865 (PNL-SA—11172) Wind-behavior research in the Wind-Energy-Technology Program.** Wendell, L.L. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 8p. (CONF-830631—9). NTIS, PC A02/MF A01. Order Number DE83013823.

From 6. biennial wind energy conference; Minneapolis, MN, USA (1 Jun 1983).

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The portion of the Wind-Energy-Technology Program devoted to research on wind behavior has undergone a significant shift in emphasis over the past two years. Priorities have been shifted to research focusing on the direct interaction of the turbine and the winds. Because of the activity in the design and testing of large wind turbines over the past two years, a high priority has been given to experiments and studies of microscale turbulence affecting wind-turbine stresses. Emphasis has also been placed on wind variability as it relates to turbine operating strategy and energy capture. The spacing between turbines in a cluster is an important factor in the effectiveness of the cluster in extracting maximum energy from the wind without significantly affecting the turbine design life. The major tasks ahead are the development and testing of relisble models to simulate the effects of rotational sampling from single towers or remote sensing devices. As more wind turbines and turbine clusters are placed in service, further research should be conducted on space and time variability of the wind.

**38866 (SAND—82-2504C) Small wind turbine with battery storage stand-alone experiment.** Butler, P.C.; Freese, J.M.; Miller, D.W.; Price, G.D.; Carlson, J.N. (Sandia National Labs., Albuquerque, NM (USA); Rockwell International Corp., Golden, CO (USA). Energy Systems Group). 1983. Contract AC04-76DP00789. 10p. (CONF-830631—7). NTIS, PC A02/MF A01. Order Number DE83013751.

From 6. biennial wind energy conference; Minneapolis, MN, USA (1 Jun 1983).

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An experiment to evaluate battery storage with a stand-alone wind generator system is being pursued jointly by Sandia National Laboratories (SNL) and the Rocky Flats Small (<100 kW) Wind Systems Test Facility (Rockwell International). The goal of the experiment is to evaluate the performance, life, and maintenance requirements of batteries in a stand-alone environment. Also, the operating characteristics and life of the wind turbine are being evaluated. This paper will discuss in detail the system components and instrumentation as well as the initial battery capacity testing and

load cycle testing. Partial results from the first four months of data will be presented.

**38867 (SERI/TP—211-1978) Height extrapolation of short- and long-term averaged wind data.** Mikhail, A.S. (Solar Energy Research Inst., Golden, CO (USA)). May 1983. Contract AC02-77CH00178. 9p. (CONF-830622—14). NTIS, PC A02/MF A01. Order Number DE83011963.

From American Solar Energy Society meeting; Minneapolis, MN, USA (1 Jun 1983).

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Various models that are used for height extrapolation of short and long-term averaged wind speeds are discussed. Hourly averaged data from 3 tall meteorological towers (the NOAA Erie Tower in Colorado, the Battelle Goodnoe Hills Tower in Washington, and the WKY-TV Tower in Oklahoma), together with data from 17 candidate sites (selected for possible installation of large WECS) were used to analyze the variability of short-term average wind shear with atmospheric and surface parameters, and the variability of the long-term Weibull distribution parameter with height. The exponents of a power law model, fit to the wind speed profiles at the three meteorological towers, showed the same variability with anemometer level wind speed, stability, and surface roughness as the similarity law model. Of the four models representing short-term wind data extrapolation with height (1/7 power law, logarithmic law, power law, and modified power law), the modified power law gives the minimum rms for all candidate sites for short-term average wind speeds and the mean cube of the speed. The modified power law model was also able to predict the upper-level scale factor for the WKY-TV and Goodnoe Hill Tower data with higher accuracy. All models were not successful in extrapolation of the Weibull shape factors.

**38868 (SERI/TP—211-1984) SERI Advanced and Innovative Wind-Energy-Concepts Program.** Mitchell, R.L.; Jacobs, E.W. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1983. Contract AC02-77CH00178. 13p. (CONF-830622—13). NTIS MF A01. Order Number DE83011960.

From American Solar Energy Society meeting; Minneapolis, MN, USA (1 Jun 1983).

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In 1978 the Solar Energy Research Institute (SERI) was given the responsibility of managing the Advanced and Innovative Wind Energy Concepts (AIWEC) Task by the US Department of Energy (DOE). The objective of this program has been to determine the technical and economic potential of advanced wind energy concepts. Assessment and R & D efforts in the AIWEC program have included theoretical performance analyses, wind tunnel testing, and/or costing studies. Concepts demonstrating sufficient potential undergo prototype testing in a Proof-of-Concept research phase. Several concepts, such as the Dynamic Inducer, the Diffuser Augmented wind Turbine, the Electrofluid Dynamic Wind-Driven Generator, the Passive Cyclic Pitch concept, and higher performance airfoil configurations for vertical axis wind turbines, have recently made significant progress. The latter has currently reached the Proof-of-Concept phase. The present paper provides an overview of the technical progress and current status of these concepts.

**38869 Capacity credit of tipvane rotors.** Janssen, A.J. Petten, Netherlands; Stichting Energieonderzoek Centrum Nederland (1983). 20p. (In Dutch). (ECN—83-056). Available from ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Wind turbines equipped with tipvanes give more power output, while the time during which no power can be delivered will be reduced. So the capacity of a windpark can be increased by using tipvanes, or, more realistically, less or smaller wind turbines can be built for a given power capacity if tipvane rotors are mounted. This gives a substantial reduction in investment and maintenance costs. Calculations were made for four types of wind turbines: two types equipped with tipvane rotors and two conventional types. Power capacity curves are calculated with a computer program (WECS) developed by the author and co-workers. Total saving of investments depends on many financial and economic factors and can amount to 35%.

**38870 Dynamics and control of large horizontal-axis wind turbines.** Yu, Y.Y. (New Jersey Inst. of Tech., Newark). pp 510-519 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon press (1982). (CONF-821121—).

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

To investigate the feasibility of converting wind energy into a readily useful form, the US Federal Wind Energy Program was established in 1973, with the Department of Energy assigned to have the overall responsibility and Lewis Research Center of National Aeronautics and Space Administration to be responsible for developing large horizontal-axis wind-turbine systems. Projects that have been undertaken include the MOD-O, MOD-OA, MOD-1, MOD-2, MOD-5, and MOD-6H. Of these, the first four have been completed, and they are summarized in this paper. Technologies involved with dynamics and control of such turbines are also reviewed. These cover aerodynamics, structural and rotor dynamics, power-train dynamics, and system dynamics. Some of the tools used in the dynamic analyses, including computer codes, are further discussed.

# 20 ELECTRIC POWER ENGINEERING

*REFER ALSO TO CITATION(S) 38987*

## 2001 Power Plants And Power Generation

*REFER ALSO TO CITATION(S) 38597, 39271*

**38871 (CONF-830583—2) Electric-utility deregulation: estimated price and welfare consequences.** Hobbs, B.F.; Shuler, R.E. (Oak Ridge National Lab., TN (USA); New York State Public Service Commission, Albany (USA); Cornell Univ., Ithaca, NY (USA). Dept. of Environmental Engineering). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE83012632.

From American Association for the Advancement of Science annual meeting; Detroit, MI, USA (26 May 1983).

The existing system of regulating electric utilities is widely thought to discourage efficiency and innovation and to weaken the industry's financial health. Consequently, the deregulation of electric generation, which would substitute the carrot and stick of competition for government overview of rates and investments, has been proposed as one solution to the problem. Several proposals would separate the industry's functions. As an example, a regulated or publicly owned transmission entity might transmit power from unregulated competitive generation companies to large customers and local distribution firms. But the resulting bulk power market would be oligopolistic. This is because significant scale economies and transmission costs would ensure that generation firms would compete with only a few neighbors; as a result, prices would in general exceed marginal cost. The purpose of this paper is to simulate such deregulated power markets, and to compare the resulting bulk power prices against: (1) regulated prices based on embedded average cost; and (2) marginal cost pricing. Because it is difficult to estimate their magnitude, no credit is taken for production efficiency gains that might result from competition. Thus, identical cost patterns are assured for all scenarios, and the focus is on allocative (pricing) efficiency.

**38872 (DOE/BP—151-Vol.1) Bonneville Power Administration comparative electric-generation study. Final report. Volume I.** Doyle, J.; Lang, R.; Arpi, D. (Raymond Kaiser Engineers, Inc., Oakland, CA (USA)). Jan 1983. 433p. NTIS, PC A19/MF A01. Order Number DE83012908.

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The primary objective of this study was to calculate levelized busbar power costs for case studies of each technology. A secondary objective of the study was to analyze the benefits and constraints of each technology, a summary of which is presented at the beginning of each section. The technology attributes provide a qualitative review of each technology and should be further studied

in any decision-making process. Comparative conclusions were not drawn in this preliminary review.

38873 **(DOE/EIA—0044(81)) Statistics of privately owned electric utilities, 1981 annual (Classes A and B companies).** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jun 1983. 532p. NTIS, PC A23/MF A01. Order Number DE83013569.

This publication presents the 45th consecutive year of comprehensive financial and operating information on all the large privately owned electric utility companies operating in the United States. The information has been taken from the annual reports of Classes A and B electric utilities presented to the Energy Information Administration (EIA) for the year 1981. Class A utilities are those having an annual electric operating revenue of $2.5 million or more. Class B utilities are those having annual electric operating revenues of $1 million or more, but less than $2.5 million. The information on electric utility net generation (page 25) that pertains to the entire electric utility industry is compiled from monthly reports of electricity generation filed with the EIA by all electric utilities that operate generating facilities.

38874 **(DOE/EIA—0172(81)) Statistics of publicly owned electric utilities, 1981 annual.** Brown, S.E. Jr. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). May 1983. 141p. NTIS, PC A07/MF A01. Order Number DE83013369.

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The 1981 edition of Statistics of Publicly Owned Electric Utilities in the United States includes an index listing of the names of each reporting municipal utility by state, or states, in which it operates. Summaries containing data from all 162 municipal electric utilities include: balance sheet and statements for income accounts, electric operating revenues, electric utility plant, electric operation and maintenance expenses, energy accounts, and physical quantities.

38875 **(DOE/EIA—0226(83/03)) Electric power monthly.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Mar 1983. 43p. NTIS, PC A03/MF A01. Order Number DE83013404.

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Data are given on US electric utilities' net generation, fuel consumption, fuel stocks, fuel receipts, fuel costs, electricity sales, and retail prices of electricity. (MOW)

38876 **(DOE/ET/13333—T2) Gas-turbine demonstration of pyrolysis-derived fuels. Final technical report, September 1978-June 1982. Teledyne CAE report No. 1901.** Jasas, G.; Kasper, J.; Trauth, R. (Teledyne CAE, Toledo, OH (USA)). Jun 1983. Contract AC03-78ET13333. 116p. NTIS, PC A06/MF A01. Order Number DE83013610.

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As part of the National Petroleum Conservation effort, a potential non-petroleum-base alternate fuel for gas turbines has been identified. This fuel is derived from agricultural and forestry products/wastes through a pyrolysis conversion. Three combustible products are produced - heavy oil, residual char, and gas. Blending of the char and oil products yields a two-phase (slurry) fuel with a heating value that is approximately 85% (volumetric) of typical petroleum-base fuels. The work under this contract is directed to evaluate this pyrolysis-derived fuel slurry in a direct-fired gas-turbine application. Analysis of the combustion process was conducted and the indicated hardware designs were procured. Test evaluations were carried out in a gas-turbine combustor rig operated at approximately one-atmosphere inlet pressure. The pyrolytic fuel properties and characeristics were measured along with its effects on typical materials used in gas-turbine engines. Test results indicate that the process is technically viable with a potential of high combustion efficiency. Additional fuel-properties refinement along with combustor and fuel handling modifications will be necessary to bring this technology up to threshold for commercialization. 51 figures, 7 tables.

38877 **(DOE/PE/70047—T4) Efficient supply of electricity: an introduction to policy alternatives. Task 6. Final report.** Stone, R.F.; Davis, S.H. (Technology and Economics, Inc., Cambridge, MA (USA)). 19 Sep 1980. Contract AC01-79PE70047. 55p. NTIS, PC A04/MF A01. Order Number DE83013876.

In this paper we consider various government policies which might serve to promote the efficient supply of electricity. Our objective is to provide a broad overview of the major features and anticipated effects of these policy alternatives and to stimulate further, more thorough, analysis of those policies which appear particularly promising. A partial bibliography of books, journals, and other documents pertaining to the supply of electricity accompanies this paper, and the interested reader is directed to relevant materials in the bibliography as individual topics are discussed.

38878 **(DOE/RG—0062) Electricity exchanges across international borders - 1982.** (USDOE Economic Regulatory Administration, Washington, DC. Office of Fuels Programs). May 1983. 39p. NTIS, PC A03/MF A01. Order Number DE83013482.

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A summary is given of the amount of electricity imported to and exported from the US, as well as the respective costs and revenues. Total transactions are listed for each holder of one or more Presidential Permits. Permit holders are grouped by the regional reliability councils of the North American Electric Reliability Council. Transactions with Canada and Mexico are listed separately.

38879 **(EPRI-CS—2961) Current cathodic protection practice in steam surface condensers.** Gehring, G.A. Jr. (Ocean City Research Corp., NJ (USA)). May 1983. 84p. NTIS, PC A05/MF A01. Order Number DE83902340.

This report covers the results of a survey conducted to determine current practice regarding the implementation of cathodic protection in the waterboxes of steam surface condensers. The report discusses the more important components of a condenser cathodic protection system and the principal design factors governing the choice of the various components. The report summarizes information obtained from 28 electric power utilities currently using cathodic protection in their surface condensers and documents the specific characteristics of their condenser cathodic protection systems as a function of cooling water salinity, geographic location, and condenser material combination. The report also summarizes periodic surveillance procedures, typical maintenance problems, and the extent to which protective coatings are being used in conjunction with cathodic protection in surface condensers.

38880 **(EPRI-EL—2561-Vol.4) Electric-generation expansion analysis system. Volume 4. Programmer's manual. Final report.** Fleck, W.D.; Charny, L. (Stone and Webster Engineering Corp., Boston, MA (USA)). May 1983. 461p. NTIS, PC A20/MF A01. Order Number DE83902343.

EGEAS is a modular state-of-the-art capacity expansion software package. It contains five capacity expansion analysis options ranging from preliminary analysis tools based on screening curves and linear programming to sophisticated non-linear analysis tools utilizing a Generalizd Benders' Decomposition algorithm and a Dynamic Programming algorithm. A stand alone, detailed probabilistic production costing algorithm is also available for prespecified expansion plan production cost and reliability analysis. The multiple EGEAS analysis options are incorporated into a single control analysis program allowing users to match the analysis option selected to a particular problem's requirements and complexity. At the same time, the implementation of a flexible modular and extendable data base common to all five analysis options simplifies data input and maintenance, and rules out input-related inconsistencies among the analysis options. The development and implementation of a detailed but nevertheless efficient probabilistic production costing algorithm made possible the addition to EGEAS of a number of advanced features. These features include maintenance scheduling, economy interchange and reserve sharing, storage and limited energy unit modeling as well as Non-Dispatchable Generation and Load Management analysis. Sensitivity, uncertainty and trade-off analyses are also available in EGEAS.

38881 **(EPRI-EL—3001) Railroad electrification on utility systems. Final report.** Burke, J.J.; Feltes, J.W. (Power Technologies, Inc., Schenectady, NY (USA)). Mar 1983. 153p. NTIS, PC A08/MF A01. Order Number DE83902305.

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A nine-month project was undertaken on the subject of the impact of railroad electrification on utility systems. The objectives of this study were achieved by a review of the literature, discussions with railroads and electric utilities with electrification experience, review of the present solution techniques and computational tools, and quantitative illustrations of the impact of railroad loads on utility systems. Representative simulations were run to address some of the major utility concerns such as unbalance, power factor, voltage drop, resonance and harmonics. The relative applicability of present day digital and analog computational techniques were evaluated as they relate to large, single phase, rectified loads. Finally, the needs of the utility in the area of railroad electrification were identified.

38882 **(EPRI-EM—2991) Issues in residential load management. Final report.** Witwer, J.G. (Strategies Unlimited, Mountain View, CA (USA)). Apr 1983. 63p. NTIS, PC A04/MF A01. Order Number DE83902333.

The purpose of this project was to review the state-of-the-art of residential load-management systems and to identify key research and development issues whose resolution would advance these technologies. The project utilized two techniques to accomplish this review and issues identification: a telephone interview program of load-management systems suppliers and a two-day workshop whose participants included systems suppliers, utility representatives, independent researchers, and EPRI staff. The interview program involved a total of 24 firms, including those currently offering load-management systems, those developing such systems, and firms in related business areas such as computers and communications. This interview program provided important background for the workshop, at which more specific research and development issues were identified and discussed.

38883 **(FE—1806-59) Development of high-temperature turbine subsystem technology to a technology readiness status, Phase II. Quarterly report, October 1978-December 1978.** (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). 1978. Contract AC01-76ET10340. 191p. NTIS, PC A09/MF A01. Order Number DE83013503.

The objectives of the Phase II technology testing and test support studies are to: perform component design and technology testing in critical areas; perform system design and trade-off analyses in sufficient depth to support the component design and test tasks; and update the combined cycle studies to evaluate the commercial viability of a technology readiness vehicle turbine system. Progress is reported in the areas of: hot gas development tests; turbine simulator tests; shock tunnel tests; low-temperature, low-Btu gas cleanup system tests; aerodynamic tests; motorized rig tests; air turbine tests; update of liquid gas-fueled combined-cycle power plants; update of reference turbine subsystem design; update of verification system definition; technology readiness vehicle design; and program management, documentation, review, and evaluation. (LEW)

38884 **(FE—2465-9) Erosion study in turbomachinery affected by coal ash particles. Annual progress report, October 1, 1977-October 1, 1978.** Tabakoff, W.; Hamed, A. (Cincinnati Univ., OH (USA). Dept. of Aerospace Engineering and Applied Mechanics). Nov 1978. Contract AC01-76ET10620. 89p. NTIS, PC A05/MF A01. Order Number DE83013505.

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This Annual Report describes, in general, the progress during the period from October 1, 1977 to October 1, 1978. In order to provide basis for alloy selection in future turbines using pulverized coal, an investigation is undertaken to obtain the basic understanding of the mechanisms of erosion at ambient and high temperatures. The test equipments have been designed in such a way that they can simulate the aerodynamic and thermodynamic conditions in the turbine. In addition the dynamic behavior of the solid (ash) particles through the turbine are discussed.

38885 **(GAO/RCED—83-64) Changes in the Bonneville Power Administration's billing practices could reduce interest costs and improve cash flow.** (General Accounting Office, Washington, DC (USA)). 28 Feb 1983. 14p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

A review of electricity billing practices revealed that if the Bonneville Power Administration (BPA) changed its customer billing processes, more than $3.2 million in interest expenses could be avoided annually. These savings could be obtained by: (1) billing utility customers promptly ($1.8 million); (2) negotiating contract changes requiring California utility customers to pay monthly, rather than quarterly ($1.4 million); and (3) requiring Federal agency customers to pay interest on late payments ($60,000). These interest expense savings would result from less short-term borrowing by BPA since monies due would be received more quickly and on a regular monthly basis.

38886 **(TVA/PUB—83/33) Repair of a water-cooled field coil for a hydroelectric motor/generator.** Miller, L.J. III. (Tennessee Valley Authority, Chattanooga (USA)). 1983. 7p. NTIS, PC A02/MF A01. Order Number DE83902014.

Four reversible pump/turbine units at TVA's Raccoon Mountain Pumped-Storage Plant were placed in service in 1978 to 1979. The stator and rotor windings for the motor/generators are direct water cooled. This paper describes repairs to a water-cooled coil of one of the 24 field poles of Unit No. 3 motor/generator placed in service in February 1979.

38887 **(UT/CES-RR—15) Optimization approach to electric-utility corporate models.** Bose, R. (Texas Univ., Austin (USA). Center for Energy Studies). Dec 1982. 120p. NTIS, PC A06/MF A01. Order Number DE83902166.

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Significant work has appeared in the literature on supply-side (plant sector) optimization models for the planning of electric utility generating systems. This report represents an attempt to integrate the plant sector with a financial model for electric utilities in an optimization framework. The idea is an extension of the concept of electric utility corporate models, which are commonly used in the industry for system planning applications. Hence, the model has been called a corporate optimization model (COM).

## 2002 Environmental Aspects

*REFER ALSO TO CITATION(S) 38376*

## 2003 Power Transmission And Distribution

*REFER ALSO TO CITATION(S) 38902*

38888 **(DOE/ET/29011—T1) Mechanical behavior of underground laminar-pipe-type power-cable systems. Draft on final report.** Greenwood, A.N.; Spillers, W.R. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Sep 1981. Contract AC02-78ET29011. 310p. NTIS, PC A14/MF A01. Order Number DE83013009.

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This contract is concerned with the phenomenon of thermo-mechanical bending (TMB) which occurs in underground, laminar, pipe-type power cable systems. Under TMB, thermal length change caused by load cycling produces a complex mechanical response including bending of the individual cables. When this phenomenon is severe it can lead to the formation of soft spots and subsequently electrical failure. This contract is directed to the development of analytical methods to describe the TMB phenomenon with the intention of establishing cable parameters to obviate TMB problems in subsequent designs as cable voltages (and cable diameters) increase.

**38889 (DOE/ET/29063—T1) Superconducting fault-current limiter. Final report.** (Gould-Brown Boveri, Colmar, PA (USA)). 15 Aug 1980. Contract AC01-78ET29063. 545p. NTIS, PC A23/MF A01. Order Number DE83003499.

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A superconducting fault current limiter (SCFCL) is introduced to limit the fault current to 100kA maximum. Ratings for SCFCLs to achieve this goal are derived. For the case where a SCFCL is used in each bus-tie at the generator substation, the SCFCL must limit the current to 43kA (rms). The various types of SCFCLs, saturating and shielded inductive devices, and resistive types, are briefly analyzed and compared. The resistive type of limiter is shown to be most highly ranked. Inductive SCFCLs require large amounts of iron, have higher losses and cause large transient current offsets which prevent early breaker opening. Operating characteristics of the resistive SCFCL are derived by use of transient circuit and heat transfer analyses. The experimental program on the resistive SCFCL carried out by Argonne National Laboratory is described.

**38890 (DOE/ET/29366—T1) Research and development of a methodology for the emergency state control for electric-energy systems. Final report.** Usoro, P.B.; Rouhani, R. (Scientific Systems, Inc., Cambridge, MA (USA)). Mar 1983. Contract AC01-79ET29366. 52p. NTIS MF A01. Order Number DE83013057.

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This report presents the development of a stochastic approach to solving the emergency state control problem in electric power systems. It identifies slow speed dynamics and cascading failures as characterizing many major electric power system collapses and presents a probabilistic representation of the uncertain changes in power system's configuration. The control algorithm looks several time steps ahead to account for system uncertainty and is aimed at guiding the system from emergency state back into a normal state in an optimal fashion. Algorithms for performing the constrained nonlinear optimization arising from the control computation are reviewed and a state-of-the-art multi-purpose nonlinear optimization code is recommended. The main contribution of this research project is that the uncertainty in power system dynamics is clearly addressed and the emergency state control problem is formulated as a stochastic control problem to reflect the true nature of the system. Furthermore, the stochastic control problem is solved using a sequential decision tree strategy with manageable computational requirements.

**38891 (EPRI-EL—3011) Examination of distribution cables for chemical and physical changes upon aging in the field and laboratory. Final report.** Johnson, J.F.; Shaw, M.T. (Connecticut Univ., Storrs (USA). Inst. of Materials Science). Mar 1983. 49p. NTIS, PC A03/MF A01. Order Number DE83902331.

The aging of power cables produces changes in physical, chemical and electrical properties. To determine in an acceptably short time the resistance of cable materials to aging, the aging stresses are usually raised to levels several times those normally encountered in the field. The validity of conclusions drawn from results under all conditions employed in such tests has not been demonstrated. Using several traditional polymer characterization tools, distribution cables aged under accelerated conditions from EPRI Project RP 1357-01 were compared with similar cables recovered from the field, and with one recovered cable that was manufactured many years ago but never energized. (All of these cables were insulated with high molecular weight polyethylene.) Some differences in the aging characteristics of the different cables were found, e.g. field-aged cables showed little change in molecular weight disribution, while laboratory-aged cables experienced a loss of low molecular weight species. Other characteristics were similar; melting points increased and oxidation induction times decreased with both field and laboratory aging. This report represents the first detailed study of this type, and compares examples of aged and unaged field-recovered cables and accelerated aged cables.

**38892 (EPRI-EL—3014) Optimization of the design of metallic shield-concentric conductors of extruded dielectric cables under fault conditions. Final report.** Silver, D.A.; Lukac, R.G.; Hartlein, R.A. (Pirelli Cable Corp., Union, NJ (USA); Georgia Power Co., Atlanta (USA)). Apr 1983. 149p. NTIS, PC A07/MF A01. Order Number DE83902332.

Short-circuit tests were performed on twenty-seven cable constructions incorporating two basic shield designs and a number of commonly used insulation shield and jacket compounds. Cables were tested unaged, aged to simulate normal and emergency operating conditions and in straight and bent configurations.

**38893 (EPRI-EL—3085) Distribution fault-current analysis. Final report.** Burke, J.J.; Douglass, D.A.; Lawrence, D.J. (Power Technologies, Inc., Schenectady, NY (USA)). May 1983. 332p. NTIS, PC E12/MF A01. Order Number DE83902342.

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A four-year project was undertaken to provide an accurate description of the magnitude and characteristics of fault currents experienced on electric utility distribution systems. To obtain information on these characteristics, extensive system measurements and analyses were performed on fifty distribution feeders belonging to thirteen different utility systems. Actual fault data was recorded on cassette tape by digital fault recorders specifically developed for utility fault applications, and was then analyzed by a series of computer programs. Various fault parameters such as number of faulted cycles, fault current dc offset, fault resistance, and cold load pickup characteristics were calculated. Comparisons were made between actual and calculated fault current magnitudes. Harmonic analysis of fault waveforms was performed to determine harmonic content up to 10 kHz. Plots of the statistical distributions of all observed and calculated fault parameters are presented, along with plots of all recorded voltage and current waveforms.

**38894 (EPRI-EL—3088) Global-error analysis for the application of the trapezoidal rule to systems with nearly periodic components. Final report.** Shniad, H.; Dembart, B.; Manke, J.W.; Neves, K.W. (Boeing Computer Services Co., Tukwila, WA (USA). Energy Technology Applications Div.). May 1983. 111p. NTIS, PC A06/MF A01. Order Number DE83902266.

As the complexity, size, and cost of stability analysis grows, the need for economical estimation of the accuracy of the results increases. Relatively inexpensive methods for the estimation of local error (the error incurred during one time step of the integration process) are known. The relation between local error and global error (i.e., the error over a fixed transient time) is both problem and method dependent. The reliable estimation of global error is difficult and usually expensive. In this report a practical and accurate method for global error estimation for problems with large oscillatory components is presented. This method is directly applicable to transient stability. Appended to this report is a thorough investigation of several classical global error estimation methods as they apply to the mixed differential and algebraic systems found in transient stability analysis. In addition, this appendix discusses the related topic of system sensitivity analysis.

**38895 (GAO/EMD—82-80) Analysis of Bonneville Power Administration's estimate to bury segments of transmission line in Montana.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 7 May 1982. 5p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

This study was made in order to evaluate the validity of BPA's cost data for burying portions of a twin 500 kV transmission line, and analyze the general engineering reliability and safety considerations of burying such lines. We found BPA's estimates of $7.1 to $7.4 million per mile to bury the transmission lines are reasonable. However, because this type of installation is not common, uncertainties exist which could make the actual costs higher or lower. For this same reason, little is known about the engineering, reliabil-

ity, and safety considerations of underground installation for lines of this size.

38896 **(TVA/PUB—83/32) Retrofilling mineral-oil-filled transformers containing PCBs.** Nail, D.M. (Tennessee Valley Authority, Chattanooga (USA)). 1983. 4p. NTIS, PC A02/MF A01. Order Number DE83902020.

The retrofilling technique used in this study consisted of draining a transformer of its mineral oil, flushing or hosing down the core and winding with approximately 20% of the transformer's liquid volume with noncontaminated mineral oil, and refilling with noncontaminated oil. During this retrofill operation, the drained transformer oil and the flush oil were emptied separately into Department of Transportation approved drums (two bunghole, sealed-top drums) so that independent samples could be taken. From the analysis of these samples, the effectiveness of this retrofill technique was evaluated and base data was established to reach conclusions about leaching of PCB from the core and winding of a transformer.

# 21 NUCLEAR POWER PLANTS

*REFER ALSO TO CITATION(S) 38875, 38987*

38897 **(ALO—1020) Feasibility and desirability study of implementing a duty-cycle data-collection system as part of NPRDS.** Van Howe, K.R.; Koppe, R.H.; Voegtle, R.B.; Kline, S.C.; Olson, E.A.J. (Stoller (S.M.) Corp., Boulder, CO (USA)). [nd]. Contract AC04-76DP00789. 77p. NTIS, PC A05/MF A01. Order Number DE83013724.

The objective of this project was to investigate cost-effective ways to improve the Nuclear Plant Reliability Data System (NPRDS) failure statistics as they are affected by the component-usage question. The nominal way to improve these statistics is to record, and to some extent describe, each operation of a safety component as well as each failure. Failures per demand or failures per operating hour could then be determined. It was recognized that such component-usage data collection for even a small number of key components could be costly or otherwise impractical. The reporting requirements for nuclear units are already burdensome and frequently redundant or overlapping. Therefore, the desirability of these information retrieval plans, in terms of the expected burdens and benefits, was also a consideration to be addressed, in addition to the feasibility of actually implementing such data collection.

38898 **(DOE/NE/34101—T1) Integrated MIS plan for the Office of Nuclear Energy.** (Davis (L.R.) and Co., Washington, DC (USA)). 10 Feb 1983. Contract AC01-83NE34101. 68p. NTIS MF A01. Order Number DE83012793.

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This plan draws heavily from the results of the Requirements Study which is currently nearing completion. In addition, the current Management Information System (MIS) support for the Office of Nuclear Energy (NE) was reviewed to provide an additional input for the basis for a plan. Section one of this report consists of organizational overview of NE and statements of the organizations, missions, goals and objectives of the offices within NE. The MIS support needs and an overview of the MIS changes required to meet these needs are given in sections two and three. Section four gives an overall planning approach and a description of the steps needed to document the development of the MIS.

## 2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

*REFER ALSO TO CITATION(S) 38919, 38920, 38922, 38924, 38929, 38935, 38936, 38937, 38944, 38951, 38952, 38953, 38955, 38956, 38957, 38968, 38968, 38970*

38899 **(DOE/NE—0048/2) UPDATE. Nuclear-Power Program information and data, January-March 1983.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Converter Reactor Deployment). May 1983. 83p. (PB—83-911502). NTIS, PC A05/MF A01. Order Number DE83013729.

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UPDATE is published by the Office of Converter Reactor Deployment, Office of Nuclear Energy, to provide a quick reference source on the current status of nuclear powerplant construction and operation in the United States and for information on the fuel cycle, economics, and performance of nuclear generating units. Similar information on other means of electric generation as related to nuclear power is included when appropriate. The subject matter of the reports and analyses presented in UPDATE will vary from issue to issue, reflecting changes in foci of interest and new developments in the field of commercial nuclear power generation.

38900 **(NUREG—0939) Example calculations illustrating methods for analyzing ductile flaw stability in nuclear pressure vessels.** Merkle, J.G.; Johnson, R.E. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation; Oak Ridge National Lab., TN (USA)). May 1983. 26p. NTIS, PC A03/MF A01 - GPO $3.50. Order Number DE83902242.

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This report contains example calculations of ductile flaw instability stresses for hypothetical flaws in nuclear pressure vessels. For comparison, three different methods of estimating upper shelf toughness as a function of Charpy impact energy were used, namely: a power law R-curve correlation, the Rolfe-Novak correlation and the Paris $J_{50}$ correlation. All three methods were used in LEFM calculations including a plastic zone size correction, and gave similar results, with the Paris $J_{50}$ method being the most conservative at low Charpy upper shelf energy levels. Safety factors based on the tearing modulus ratio T/sub mat//T/sub appl/ can exceed those based on load by considerable amounts and use of them at this time is not recommended. The use of resistance curve data obtained from actual vessel material test specimens is recommended over the use of correlations. Furthermore, evaluation of a recently proposed modified crack extension adjustment procedure for R-curve data, which is not overconservative, is recommended.

38901 **(NUREG/CR—2770) Common-cause fault rates for valves. Estimates based on licensee event reports at US commercial nuclear power plants, 1976-1980.** Steverson, J.A.; Atwood, C.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1983. Contract AC07-76ID01570. 162p. (EGG-EA—5485(83)). NTIS, PC A08/MF A01 - GPO $6.50. Order Number DE83008729.

This report presents estimates of common-cause fault rates and related quantities, based on Licensee Event Reports for valves in nuclear reactors. The Licensee Event Report data base is described. For estimating rates, the binomial failure-rate model is used, extended to allow for the substantial observed plant-to-plant variability, and for shocks that by their nature make all the valves in a system inoperable. Every quantity is estimated by both a point estimate and a 90% interval.

38902 **(PNL—4685) Electric power transmission for a Hanford Nuclear Energy Center (HNEC).** Harty, H.; Dowis, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76RL01830. 59p. NTIS, PC A04/MF A01. Order Number DE83013850.

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The original study of transmission for a Hanford Nuclear Energy Center (HNEC), which was completed in September 1975, was updated in June 1978. The present 1983 revision takes cognizance of recent changes in the electric power situation of the PNW with respect to: (1) forecasts of load growth, (2) the feasibility of early use of 1100 kV transmission, and (3) the narrowing opportunities for siting nuclear plants in the region. The purpose of this update is to explore and describe additions to the existing transmission system that would be necessary to accommodate three levels of generation at HNEC. Comparisons with a PNW system having new thermal generating capacity distributed throughout the marketing region are not made as was done in earlier versions.

**38903 (UCID—19706) Technical-evaluation report on the monitoring of electric power to the reactor-protection system for the James A. Fitzpatrick Nuclear Power Plant, Docket No. 50-333.** Selan, J.C. (Lawrence Livermore National Lab., CA (USA)). 15 Jun 1983. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01. Order Number DE83013701.

This report documents the technical evaluation of the monitoring of electric power to the reactor protection system (RPS) at the James A. Fitzpatrick Nuclear Power Plant. The evaluation is to determine if the proposed design modification will protect the RPS from abnormal voltage and frequency conditions which could be supplied from the power supplies and will meet certain requirements set forth by the Nuclear Regulatory Commission. The proposed design modifications will protect the RPS from sustained abnormal voltage and frequency conditions from the supplying sources.

## 2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

*REFER ALSO TO CITATION(S) 38501, 38899, 38900, 38901, 38902, 38916, 38919, 38920, 38922, 38924, 38925, 38936, 38945, 38946, 38947, 38948, 38949, 38950, 38952, 38955, 38956, 38958, 38959, 38960, 38965, 38969, 38972*

**38904 (CEA-CONF—6461) Nuclear data for fission reactors.** Michaudon, A. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Sep 1982. 6p. (CONF-820950—8). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702019.

From Conference on the neutron and its applications; Cambridge, UK (13 Sep 1982).

Nuclear reactions induced by neutrons play an important role in fission reactors and relevant cross-sections need to be known with great accuracy. After a brief history and a general presentation, the nuclear data situation is discussed for Pressurized-Water and Liquid-Metal Fast Breeder Reactors.

**38905 (DPST—83-248) Evaluation of zeolite mixtures for decontamination of high-activity-level water in the Submerged Demineralizer System (SDS) flowsheet at the Three Mile Island Nuclear Power Station, Unit 2.** King, L.J.; Campbell, D.O.; Collins, E.D.; Knauer, J.B.; Wallace, R.M. (Oak Ridge National Lab., TN (USA); Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 16p. (CONF-830756—4). NTIS, PC A02/MF A01. Order Number DE83012203.

From 6. international zeolite conference; Reno, NV, USA (10 Jul 1983).

Mixtures of Linde Ionsiv IE-96 and Ionsiv A-51 zeolites were evaluated for use in the Submerged Demineralizer System (SDS) that was installed at the Three Mile Island Nuclear Power Station, Unit 2 (TMI-2) for decontaminating ~ 3000 $m^3$ (~ 700,000 gal) of high-activity-level water in the containment building sump. Small-scale, tracer-level column tests were made using various mixtures of the zeolites to evaluate the capability for simultaneous removal of cesium and strontium. A column loading test was made in a hot cell using a mixture of equal parts of the zeolites to evaluate the performance of the mixture in removing cesium and strontium from a sample of TMI-2 sump water. A computerized mathematical model of the mixed-bed SDS system was used to evaluate the test data in order to select a zeolite mixture and predict system performance.

**38906 (EPRI-NP—2978) State-of-the-art evaluation of condensate polisher performance. Final report.** Elmiger, S.J.; Potterton, S.J. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.; Babcock and Wilcox Co., Lynchburg, VA (USA). Utility Power Generation Div.). Apr 1983. 375p. NTIS, PC A16/MF A01. Order Number DE83902313.

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The operating environments in power plant cycles require the use of high-purity feedwater combined with careful chemical control to minimize deposition and corrosion problems. Condensate polishing system provide plant operators with a tool to control the transport of soluble impurities and corrosion products during normal operation, start-ups, shutdowns, and other plant transients. The objective of this program was to provide an understanding of the factors that influence condensate polisher performance. In order to achieve a large data base for evaluation, a lengthy and detailed plant survey was chosen as the means by which to accumulate the data. Response to the survey was excellent. Of the 268 surveys distributed, 147 were completed and returned with 135 of these included in a computerized condensate polishing data base. The data from the effort have been summarized in this report to show the environment, operation problems as performance of both deep bed and powdered condensate polisher system.

**38907 (EPRI-NP—3024) Characterization of single-tube model-boiler dented intersection specimens. Final report.** Varsanik, R.G.; Gibbon, D.L. (Calgon Corp., Pittsburgh, PA (USA)). May 1983. 91p. NTIS, PC A02/MF A01. Order Number DE83902194.

Crevice denting, caused by the uncontrolled growth of magnetite in the space between carbon-steel tube-support plates and Inconel heat-exchange tubes is a major cause of concern in nuclear steam generators. This particular form of localized corrosion has been modeled experimentally by the Westinghouse Electric Corporation using prototypical boiler systems. In this study, three corrosion specimens from these model-boiler systems have been characterized by Calgon Corporation using light and scanning electron microscopy along with both energy- and wave-length-dispersive x-ray spectrophotometry. Samples examined consisted of specimens which had been exposed to a known corrosive environment and then either left untreated, treated with calcium hydroxide, or treated with boric acid in an attempt to halt the corrosion process. The destructive examination of the samples was conducted on both polished sections as well as sections fractured in liquid nitrogen to expose uncontaminated interfaces between the multiple phases involved.

**38908 (EPRI-NP—3053) Flushing efficiency of steam-generator tube-tubesheet assemblies with restricted crevices. Final report.** Cleary, J.G.; Sweeney, G.G.; Baum, A.J.; Economy, G. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Apr 1983. 84p. NTIS, PC A05/MF A01. Order Number DE83902293.

The objective of this project was to determine the effectiveness of steam generator tubesheet crevice flushing operations when access to the crevice is restricted by particulate matter within the crevice or by a hard sludge pile on top of the tubesheet. The methodology for forming a hard, stable sludge pile was also developed. The testing indicated that the most effective flushing procedures were similar to those found to be most effective in testing of unrestricted crevices. However, the effectiveness of a given depressurization cycle was generally lower than in the unrestricted crevice testing and more cycles were required to obtain an equivalent extent of dilution. The testing produced some hideout return directly from the hard sludge and was successful in partially breaking up a sludge pile composed entirely of magnetite.

**38909 (EPRI-NP—3059) IGA of alloy 600 in high-temperature solutions of sodium hydroxide contaminated with carbonate. Final report.** Roberge, R.; Bandy, R.; van Rooyen, D. (Brookhaven National Lab., Upton, NY (USA)). May 1983. Contract AC02-76CH00016. 48p. NTIS, PC A03/MF A01. Order Number DE83014086.

Alloy 600 was tested in sodium hydroxide contaminated with sodium carbonate at 300°C and 315°C to examine its resistance to intergranular attack (IGA) under controlled cathodic and anodic potentials. Specimens of alloy 600 were studied as C-rings under constant deflection, wires under constant load and wires without any applied tensile stress. The material was mainly used in its mill annealed condition, although some specimens were studied as solution annealed and solution annealed plus sensitized. Unlike the last two metallurgical states, the mill annealed alloy 600 material was rather sensitive to stress corrosion cracking (SCC) in a range of anodic potentials.

38910 **(EPRI-NP—3097) Verification of the GFLOW computer code using experimental data from the Maine Yankee spent-fuel storage pool. Final report.** Gay, R.R.; Gloski, D.M. (NUS Corp., Menlo Park, CA (USA)). May 1983. 81p. NTIS, PC A05/MF A01. Order Number DE83902277.

Experimental measurements of the thermal hydraulic conditions at the Maine Yankee spent nuclear fuel storage pool were made 25 days after reactor shutdown and the full core had been off-loaded for the ten-year vessel inspection. The GFLOW computer code was used to pre-predict the experimental results as a guide to designing the experimental program. GFLOW is a three-dimensional numerical model of natural circulation thermal-hydraulics, developed as a tool for spent fuel pool design and licensing. To compare predictive results with actual test data, a post-test GFLOW simulation using measured pool power levels and boundary conditions was exected after the measurements were completed. Both the measurements and the computer predictions indicate that the Maine Yankee fuel storage pool is very quiescent with nearly homogenous thermal conditions at any given elevation. A thermal stratification exists in the vertical direction with temperatures varying from 92°F(33°C) at the pool bottom to 99°F (37°C) at the top surface. The average fuel assembly exit temperature is 97°F (36°C) with a maximum coolant temperature in the hottest assemblies of approximately 104°F (40°C). The average fluid velocity in the pool predicted by GFLOW was 0.09 ft/sec (0.03 m/sec). Experimentally, velocities were found to be 0.0 +- 0.2 ft/sec. Temperatures and velocities were observed to fluctuate with time at any given location in the pool. Representative magnitudes of these fluctuations are +-2°F (+-1°C) for temperature and +- 0.05 ft/sec (.02 m/sec) for velocity. In general, the GFLOW predicted temperatures were within 1°F (0.5°C) of the measured results.

38911 **(EPRI-NP—3107) Gamma-ray exposure-rate distribution in a steam generator.** Fero, A.H. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.). May 1983. 95p. NTIS, PC A05/MF A01. Order Number DE83902199.

This report describes a program in which a series of gamma-ray exposure-rate measurements were made, using thermoluminescent dosimeters, to determine the relative contribution of various surface areas within a steam generator to its overall radiation levels. The measurements are compared with analytical predictions based on discrete-ordinates and point-kernel techniques. Assessments of the radiation-source inventory of the various steam-generator surfaces are also made.

38912 **(NUREG—0986) RCSLK8: reactor-coolant-system leak-rate determination for PWRs. User's guide.** Kirkpatrick, D.C.; Woodruff, R.W. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Jun 1983. 100p. NTIS, PC A05/MF A01 - GPO $4.75. Order Number DE83902555.

RCSLK8 is a computer program that was developed to analyze the leak tightness of the primary cooling system for any pressurized-water reactor. From system conditions, water levels in tanks, and certain system design parameters, RCSLK8 calculates the loss of water from the cooling system and the increase of water in the leakage collection system during an arbitrary time interval. The program determines the system leak rates and displays or prints a report of the results. For initial application of the program at a reactor, RCSLK8 creates a file of system parameters and stores it for future use. RCSLK8 was designed for use in the field with Osborne 1 Portable Computers equipped with double-density disk drives.

38913 **(NUREG/CR—3294) Fatigue-crack growth rates of A 508-2 steel in pressurized, high-temperature water.** Cullen, W.H. (Materials Engineering Associates, Inc., Lanham, MD (USA)). Jun 1983. 32p. (MEA—2016). NTIS, PC A03/MF A01 - GPO $3.75. Order Number DE83902246.

Fatigue crack growth rates were determined for A 508-2 steel in pressurized, high-temperature, reactor-grade water, for a variety of ramp time and hold time combinations as well as sinusoidal waveforms. Tests were conducted for load ratios of 0.1 to 0.2, and at temperatures of 93°C and 288°C (200°F and 550°F). The results indicate that the trends in crack growth rates are dependent on both waveform and temperature. There is an increase in crack growth rates at low temperatures (93°C) for ramp times greater than one second, but the crack growth rates are essentially the same for ramp times ranging from 22 to 1800 seconds. Crack growth rates at high temperatures (288°C) are essentially independent of ramp time over a range of 1 second to 300 seconds; all data reside just above the ASME air environment reference line. On the other hand, 17 mHz sinusoidal waveforms and 288°C temperatures produced a significant increase in crack growth rates. There is some evidence that this behavior is a function of material chemistry, particularly sulfur content.

## 2103 Power Reactors, Non-breeding, Graphite Moderated

*REFER ALSO TO CITATION(S) 38503, 38899, 38919, 38928, 38929, 38955*

38914 **(ORNL—5960) High-temperature gas-cooled reactor technology development program. Annual progress report for period ending December 31, 1982.** Kasten, P.R.; Rittenhouse, P.L.; Bartine, D.E.; Sanders, J.P. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 231p. NTIS, PC A11/MF A01. Order Number DE83013725.

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During 1982 the High-Temperature Gas-Cooled Reactor (HTGR) Technology Program at Oak Ridge National Laboratory (ORNL) continued to develop experimental data required for the design and licensing of cogeneration HTGRs. The program involves fuels and materials development (including metals, graphite, ceramic, and concrete materials), HTGR chemistry studies, structural component development and testing, reactor physics and shielding studies, performance testing of the reactor core support structure, and HTGR application and evaluation studies.

## 2105 Power Reactors, Breeding

*REFER ALSO TO CITATION(S) 38503, 38504, 38505, 38904, 38955, 38966, 38971*

38915 **(GAO/RCED—83-87) Analysis of alternative approaches to completing the Department of Energy's water-cooled breeder program.** (General Accounting Office, Washington, DC (USA)). 25 Mar 1983. 17p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to The Subcommittee on Energy Research and Production, Subcommittee on Science and Technology, House of Representatives.

GAO evaluated alternative approaches to completing the Department of Energy's water-cooled breeder reactor program, examined the reasonableness of staffing levels involved in defueling the water-cooled breeder facility, an obtained information on the extent of industry interest in the program's results. GAO's evaluation disclosed that the Department's planned approach is a cost-effective way of completing the program when compared to other alternatives, personnel levels for defueling the Shippingport Atomic Power Station appear reasonable, and 13 of 14 nuclear industry groups and utilities contacted by GAO expressed interest in obtaining the results of the fuel evaluation phase of the program.

38916 **(WAPD-TM—1342) Installation of the Light-Water Breeder Reactor at the Shippingport Atomic Power Station (LWBR Development Program).** Massimino, R.J.; Williams, D.A. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). May 1983. Contract AC11-76PN00014. 200p. NTIS, PC A09/MF A01. Order Number DE83013696.

This report summarizes the refueling operations performed to install a Light Water Breeder Reactor (LWBR) core into the existing pressurized water reactor vessel at the Shippingport Atomic Power Station. Detailed descriptions of the major installation operations (e.g., primary system preconditioning, fuel installation, pres-

sure boundary seal welding) are included as appendices to this report; these operations are of technical interest to any reactor servicing operation, whether the reactor is a breeder or a conventional light water non-breeder core.

## 2107 Regulation And Licensing

*REFER ALSO TO CITATION(S) 38952, 38953*

38917 **(DPSPU—82-30-15) Annual harvests of Corbicula populations prevent clogging of nuclear reactor heat exchangers.** Harvey, R.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1983. Contract AC09-76SR00001. 15p. (CONF-830649—1). NTIS, PC A02/MF A01. Order Number DE83012581.

From 2. international corbicula symposium; Hot Springs, AR, USA (21 Jun 1983).

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An annual program for removal of millions of Corbicula from upstream cooling water basins has prevented reclogging of nuclear reactor heat exchanger distributor plates at the Savannah River Plant during the past seven years. There are nine 32-megaliter basins in the three operating reactor areas where some settling of particulates occurs before cooling water is passed through screens in route to heat exchangers. Annual cleanings keep silt/clam substrate levels low and clam sizes small. Data are presented on the size/age distribution for clams recolonizing basins between cleanings.

38918 **(HEDL-SA—2638) Challenge - converting to ANSI/ASME NQA Standard 1.** Nansen, J.N. (Hanford Engineering Development Lab., Richland, WA (USA)). Mar 1983. Contract AC06-76FF02170. 33p. (CONF-830475—1). NTIS, PC A03/MF A01. Order Number DE83012822.

From American Society for Quality Control conference; Richland, WA, USA (17 Apr 1983).

Prior to August, 1980, Westinghouse Hanford Company operated the Hanford Engineering Development Laboratory Quality Program in accordance with the requirements of RDT F 2-2T and RDT F 2-4T and for a short while to ANSI N45.2. Following the issuance of the national consensus standard ANSI/ ASME NQA Standard 1 in August 1979, and its acceptance by DOE, the Laboratory began making changes to meet these requirements in its internal quality program in August 1980. This was followed with the invoking of these requirements on supplier's programs and all procurement activities in March of 1981. This conversion was completed in approximately six months and provided an opportunity for several improvements. The keynote of this standard is flexibility. A major improvement noted was in the flexibility of application. The program can be tailored to meet specific needs. Vendor surveys under NQA-1 have shown positive results in that the organization and structure of the standard is much easier to follow and understand.

38919 **(NUREG—0020-Vol.7-No.2) Licensed operating reactors. Status summary report, data as of January 31, 1983.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Feb 1983. 393p. NTIS, PC A17/MF A01 - GPO. Order Number DE83902366.

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The US Nuclear Regulatory Commission's monthly LICENSED OPERATING REACTORS Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This information is collected by the Office of Management and Program Analysis, from the Headquarters Staff of NRC's Office of Inspection and Enforcement, from NRC's Regional Offices, and from utilities. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

38920 **(NUREG—0485-Vol.5-No.5) Systematic Evaluation Program. Status summary report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). 31 May 1983. 68p. NTIS, PC A04/MF A01 - GPO. Order Number DE83902557.

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Information on the Systematic Evaluation Program (SEP) is presented for the following reactors: Big Rock Point reactor; Dresden-1 reactor; Dresden-2 reactor; Ginna-1 reactor; Connecticut Yankee reactor; LACBWR reactor; Millstone-1 reactor; Oyster Creek-1 reactor; Palisades-1 reactor; San Onofre-1 reactor; and Rowe Yankee reactor.

38921 **(NUREG—0540-Vol.5-No.2) Title list of documents made publicly available, February 1-28, 1983. Vol. 5, No. 2.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). 1983. 576p. NTIS, PC A25/MF A01 - GPO. Order Number DE83902252.

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The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979.

38922 **(NUREG—0580-Vol.12-No.5) Regulatory licensing. Status summary report, May 1-May 31, 1983. Volume 12.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jun 1983. 63p. NTIS, PC A04/MF A01 - GPO. Order Number DE83902241.

This management report, Regulatory Licensing Status Summary Report, is designed to provide the necessary information for controlling the progress of review processes for central station nuclear reactor applications. Section I of this edition consists of the three summary of accomplishments, the new application forecast for OL's and CP's, and an abbreviation key. Section II represents the main body of the report and consists of the facility information. All OL's are listed first, followed by CP's, standard design reviews, other reviews, and finally, a non-power reactor summary. Each project consists of general facility data, current status for all phases of the review, and targeted and actual completion dates for all key milestones in the review.

38923 **(NUREG—0910-Rev.1) NRC comprehensive records disposition schedule.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). May 1983. 202p. NTIS, PC A10/MF A01 - GPO $7.00. Order Number DE83902261.

Effective January 1, 1982, NRC will institute records retention and disposal practives in accordance with the approved Comprehensive Records Disposition Schedule (CRDS). CRDS is comprised of NRC Schedules (NRCS) 1 to 4 which apply to the agency's program or substantive records and General Records Schedules (GRS) 1 to 24 which apply to housekeeping or facilitative records. NRCS-I applies to records common to all or most NRC offices; NRCS-II applies to program records as found in the various offices of the Commission, Atomic Safety and Licensing Board Panel, and the Atomic Safety and Licensing Appeal Panel; NRCS-III applies to records accumulated by the Advisory Committee on Reactor Safeguards; and NRCS-IV applies to records accumulated in the various NRC offices under the Executive Director for Operations. The schedules are assembled functionally/organizationally to facilitate their use. Preceding the records descriptions and disposition instructions for both NRCS and GRS, there

are brief statements on the organizational units which accumulate the records in each functional area, and other information regarding the schedules' applicability.

38924 **(NUREG/BR—0051-Vol.4-No.7) Power reactor events, November-December 1982. Vol. 4, No. 7.** Massaro, S.A. (ed.). (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Jun 1983. 35p. NTIS, PC A03/MF A01 - GPO. Order Number DE83902245.

Power Reactor Events is a bi-monthly newsletter that compiles operating experience information about commercial nuclear power plants. This includes summaries of noteworthy events and listings and/or abstracts of USNRC and other documents that discuss safety-related or possible generic issues. It is intended to feed back some of the lessons learned from operational experience to the various plant personnel, i.e., managers, licensed reactor operators, training coordinators, and support personnel.

## 2108 Economics

*REFER ALSO TO CITATION(S) 38899*

38925 **(GAO/RCED—83-84) Comments on options to reorganize the General Public Utilities Corporation.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 13 Jan 1983. 10p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD.

Answers are presented to several questions related to: helping reduce the financial burden on the ratepayers of the accident at Three Mile Island-2 reactor; and rebuilding a sound financial base for its owners.

38926 **(NUREG/CR—3194) Improved cost-benefit techniques in the US Nuclear Regulatory Commission.** Cronin, F.J.; Nesse, R.J.; Vaeth, M.; Wusterbarth, A.R.; Currie, J.W. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76RL01830. 108p. (PNL—4653). NTIS, PC A06/MF A01 - GPO $5.00. Order Number DE83013304.

The major objective of this report is to help the US Nuclear Regulatory Commission (NRC) in its regulatory mission, particularly with respect to improving the use of cost-benefit analysis and the economic evaluation of resources within the NRC. The objectives of this effort are: (1) to identify current and future NRC requirements (e.g., licensing) for valuing nonmarket goods; (2) to identify, highlight, and present the relevant efforts of selected federal agencies, some with over two decades of experience in valuing nonmarket goods, in this area; and (3) to review methods for valuing nonmarket impacts and to provide estimats of their magnitudes. Recently proposed legislation may result in a requirement for not only more sophisticated valuation analyses, but more extensive applications of these techniques to issues of concern to the NRC. This paper is intended to provide the NRC with information to more efficiently meet such requirements.

38927 **Social acceptability of energy policy: the case of nuclear power and the public.** Zinberg, D.S. (Harvard Univ., Cambridge, MA). pp 113-118 of Energy for developed and developing countries. Kursunoglu, B.N.; Couture, J.; Millunzi, A.C.; Perlmutter, A.; Scott, L. Lexington, MA; D. C. Heath and Co. (1983). (CONF-7910287—).

From International scientific forum on energy for developed and developing countries; Nice, France (29 Oct 1979).

Public protest against nuclear power and other energy policies in the US, West Germany, and Sweden contrasts sharply with an apparent lack of public involvement in Belgium, Finland, Canada, and several other countries. The author notes that the concept of an energy policy as opposed to using whatever fuel is available and cheapest is new to society, while nuclear power is unique only in its inability to overcome the historical opposition to new technology. The opposition is strengthened by the coalition of many diverse groups and the emergence of public participation in decision making. Dr. Zinberg feels that open negotiation, taken one step at a time, will be needed to depolarize the controversy and retain the nuclear option. 1 reference. (DCK)

## 2109 Process Heat Reactors

38928 **(Juel—1747) Permeation of hydrogen-isotopes through metallic materials at high temperature.** Schaefer, J. (ed.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Nov 1981. 120p. (In German and English). (CONF-8103175—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83900313.

From 4. hydrogen- and tritium-permeation conference; Juelich, F.R. Germany (11 Mar 1981).

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An introduction into the experimental requirements of the permeation measurements in the IRE of the KFA is given. It is reported about results of varied tests on corroded tube samples and the following investigation of their oxidized surfaces. Explanations concerning the importance of the tritium problems at the HTR-application for nuclear process heat utilization follow with a representation of release-rates at the example of the NPW-3000-facility and potential improvement factors. To the range of problems of the tritium removal out of the cooling circuit of HTRs a survey is given about the state of investigation concerning suitable getter-procedures and also data for the application are given.

38929 **(Juel-Spez—140) Small reactors with large safety margins and long-term storage of spent fuel elements for developing countries.** Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe). Jan 1982. 20p. (CONF-8110181—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83902393.

From Conference on nuclear technology in developing countries: problems and prospects; Trieste, Italy (12 Oct 1981).

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Due to the oil price development during the recent years the utilization of nuclear energy has become an interesting alternative also for developing countries. By reason of the low energy requirements, the still insufficient infrastructure, (which particularly occures in the lack of a reliable power supply system), and the difficulties in financing large investments, for developing countries it seems to be advisable to concentrate on small nuclear power plants. In the Federal Republic of Germany these requirements have been taken into account by a small dual-cycle natural circulation boiling water reactor as well as a small helium cooled high temperature reactor with pebble bed core. Concerning the longterm storage of spent fuel elements the concept for dry storage in so-called transport casks which has been developed in the Federal Republic of Germany seems to be highly qualified for this purpose.

# 22 NUCLEAR REACTOR TECHNOLOGY

*REFER ALSO TO CITATION(S) 38872*

## 2201 Theory And Calculation

*REFER ALSO TO CITATION(S) 39730*

38930 **(JAERI-M—9523) Proceedings of 1980 seminar on nuclear data.** Tanaka, S.; Asami, T.; Iijima, S. (eds.). (Japan Atomic Energy Research Inst., Tokyo). Jun 1981. 228p. (In Japanese). (CONF-8012107—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83780670.

From Seminar on nuclear data; Tokai, Ibaraki, Japan (10 Dec 1980).

Separate abstracts were prepared for papers from the 1980 seminar on nuclear data held in Japan. (KAW)

38931 **(Juel-Spez—160) Calculation of enrichment and of irradiation time for the fuel test elements of the AF-program.** Neef, R.D. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Jul 1982. 40p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

Calculations have been performed to investigate of a possible reduction of uranium enrichment in the fuel elements of the research reactor DIDO (FRJ-2) in Juelich. An irradiation experiment is planned with five respective test plates under typical inpile irradiation conditions. The test elements may have a maximum power density of 130 W/cm$^3$ and should reach a specified burnup of 60%. Under these conditions the calculations result in a necessary enrichment of 36 weight% $^{235}$U for the fuel of the test element.

38932 **(NUREG/CR—0200-Vols.1-2-3) SCALE: a modular code system for performing standardized computer analyses for licensing evaluation. Errata sheets for Book I, II, and II.** (Oak Ridge National Lab., TN (USA)). Jan 1982. Contract W-7405-ENG-26. 58p. (ORNL/NUREG/CSD—2/R2). NTIS, PC A04/MF A01. Order Number DE83013779.

Revised information is presented concerning standardized computer codes for reactor physics calculations.

## 2202 Components And Accessories

38933 **(EGG-M—04583) Single-channel data-validation technique for ΔP cells in turbulent flow.** Goodrich, L.D.; Brower, R.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 5p. (CONF-830518—10). NTIS, PC A02/MF A01. Order Number DE83013518.

From 29. international symposium of the Instrument Society of America; Albuquerque, NM, USA (2 May 1983).

This paper discusses a single-channel-analysis, data-validation technique which is applicable to all flow-measuring devices in turbulent conditions, can be applied in either real time or batch mode, and allows online correction of zero offset and slope coefficients. This technique of validating flow measurements eliminates the need for multiple measuring devices, thus reducing the complexity of the overall instrumentation system.

## 2204 Control Systems

*REFER ALSO TO CITATION(S) 38951*

38934 **(EGG-M—27882) Choosing sampling rates: aliasing and estimation theory.** Griffith, J.M. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 4p. (CONF-830518—11). NTIS, PC A02/MF A01. Order Number DE83013519.

From 29. international symposium of the Instrument Society of America; Albuquerque, NM, USA (2 May 1983).

Estimation theory can be applied to analyze the errors encountered in reconstructing a waveform from sample values. A simple example illustrates the estimation approach and demonstrates advantages over relying on the aliasing concept.

38935 **(NP—3902381) OECD Halden Reactor Project. Twenty-first annual report, 1980.** (Nuclear Energy Agency, 75 - Paris (France)). 1982. 56p. OECD Publications and Information Center, Suite 1207, 1750 Pennsylvania Ave., NW, Washington, DC 20006.

Information is presented concernig process supervision and control; fuel reliability and safety studies; and HBWR reactor operations.

## 2205 Environmental Aspects

*REFER ALSO TO CITATION(S) 38962*

38936 **(EPRI-NP—3117) In-plant low-level radwaste technology needs. Final report.** Baker, R.; Feizollahi, F. (NUS Corp., Gaithersburg, MD (USA)). May 1983. 110p. NTIS, PC A06/MF A01. Order Number DE83902196.

An industry-wide survey of current low-level radwaste technology was conducted to formulate a unified low-level radwaste technology improvement program. The survey reviews present designs and applications of various materials, components, and systems at both PWRs and BWRs. The performance of each subsystem of a plant radwaste management system is reviewed and present problems relating to process design and plant operation and maintenance are identified and discussed. The needs generated by these problems are identified and are reviewed in order to develop a comprehensive research and development program dedicated to improving radwaste management technology. A program made up of three subprograms is proposed. The three parts are the following: (1) existing waste generation and treatment systems, (2) alternative technologies, and (3) alternative operation and maintenance practice. Alternatives for the objectives, management, monitoring, implementation, sponsorship, scheduling, budget, and goals of each subprogram are described in this report.

38937 **(NUREG—0974) Draft environmental statement related to the operation of Limerick Generating Station, Units 1 and 2. Docket Nos. 50-352 and 50-353.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jun 1983. 332p. NTIS, PC A15/MF A01 - GPO. Order Number DE83902556.

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This Draft Environmental Statement contains the second assessment of the environmental impact associated with the operation of the Limerick Generating Station, Units 1 and 2, pursuant to the National Environment Policy Act of 1969 (NEPA) and Title 10 of the Code of Federal Regulations, Part 51, as amended, of the Nuclear Regulatory Commission regulations. This statement examines the environment, environmental consequences and mitigating actions, and environmental and economic benefits and costs. Land use and terrestrial and aquatic ecological impacts will be small. Operational impacts to historic and archeological sites will be negligible. The effects of routine operations, energy transmission, and periodic maintenance of rights of way and transmission facilities should not jeopardize any populations of endangered or threatened species. No significant impacts are anticipated from normal operational releases of radioactivity.

## 2206 Research, Test, And Experimental Reactors

*REFER ALSO TO CITATION(S) 38931, 38945, 38946, 38948, 38954*

38938 **(EGG-M—30382) Nuclear-reactor secondary-coolant-pump control with a variable frequency drive system.** Seifert, G.D.; Renak, T.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 12p. (CONF-830491—1). NTIS, PC A02/MF A01. Order Number DE83013664.

From PCI/MOTORCON 83 coference; Orlando, FL, USA (19 Apr 1983).

This paper presents the use of a variable-frequency-drive (VFD) system in the nuclear-energy field. The new design provides improved control of a reactor secondary-coolant system with considerable energy and operating cost savings. Prior to using the VFD system, the flow was controlled by several coolant pumps in parallel feeding through an inline-flow-control butterfly valve. Process control used temperature feedback to position the large butterfly valve which varied the hydraulic resistance of the system, resulting in substantial energy losses at low flow rates. The new design will add a variable-frequency-drive system and an automatic-feedback control loop to one of the existing parallel 350-hp motors. The benefits of the new design are improved accuracy and flow control with decreased operating cost. Innovative techniques were required to comply with stringent safety requirements, an existing 4160-volt power system, and providing failsafe protection.

38939 **(EGG-REP—6273) ATR task and training requirements analysis.** Gertman, D.I.; Blackman, H.S.; Gilmore, W.E. II; French, D.L. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1983. Contract AC07-76ID01570. 138p. NTIS, PC A07/MF A01. Order Number DE83013331.

Task analysis techniques were used to assist in identifying improvements needed in the training curriculum for selected positions at the Advanced Test Reactor (ATR). Six positions were examined - Experiment Power Reactor Operator, Experiment (EPRO-Ex); Experiment Power Reactor Operator, Console (EPRO-Co); Senior Reactor Engineer (SRE); Assistant Shift Supervisor (AS); Shift Supervisor (SS); and Process Control Operator (PCO). A complete position task listing and a core of tasks defined in terms of (a) level of difficulty to perform, (b) severity of consequence if performed improperly, and (c) associated error probability were identified for each position. The systems, academic, and administrative knowledge needed by job incumbents to perform each task was noted. Strategies for teaching the knowledge associated with these tasks are presented.

38940 **(HEDL-SA—2805-FP) Out-of-reactor temperature measurement in an irradiated FFTF fuel assembly.** Guzek, J.C.; Boyd, C.L.; Stover, R.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76FF02170. 19p. (CONF-830609—15). NTIS, PC A02/MF A01. Order Number DE83013655.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

This paper describes out-of-reactor temperature measurements in an irradiated FFTF fuel assembly and reviews comparisons to predicted temperatures. The predictions were based upon electrical heating test results that were used to calibrate the analytic model.

38941 **(HEDL-SA—2826-FP) Core-component measuring system at FFTF.** Trowbridge, F.R.; Romrell, D.M. (Hanford Engineering Development Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76FF02170. 5p. (CONF-830609—16). NTIS, PC A02/MF A01. Order Number DE83013713.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

The Core Component Measuring System used at the Fast Flux Test Facility, Richland, Washington, was previously reported during its developmental phase. The system has since been further evaluated and installed in the Interim Examination and Maintenance Cell and has been utilized to perform duct measurments on prototype driver fuel assemblies in an Argon atmosphere. Analysis of the measuring system has led to hardware changes and the development of data enhancement programs to improve the measurement data.

38942 **(HEDL-SA—2885-FP) Surveillance and in-service inspection of liquid-metal systems.** Humphrey, R.A.; Parker, J.E. (Hanford Engineering Development Lab., Richland, WA (USA)). Mar 1983. Contract AC06-76FF02170. 22p. (CONF-830487—1). NTIS, PC A02/MF A01. Order Number DE83012826.

From Western regional energy conference; Richland, WA, USA (17 Apr 1983).

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Surveillance and In-Service Inspection (SISI) of liquid-metal systems as discussed herein reflect the development and implementation of a SISI program for the high-temperature sodium piping associated with the primary and secondary pressure boundary of the Fast Flux Test Facility (FFTF). A beginning history of developing the program criteria, performance of the pre-service inspections during the acceptance test program and a description of the operational SISI program is presented.

## 2207 Plutonium And Isotope Production Reactors

38943 **(ORNL/TM—8772) High Flux Isotope Reactor quarterly report, January-March 1983.** Hurt, S.S.; Poteet, K.H. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01. Order Number DE83013730.

Routine reactor operation with four end-of-cycle shutdowns and one unscheduled shutdown resulted in an on-stream tiem of 91.4% for the quarter. The outer control plates were replaced and a semiannual core component inspection was made.

## 2209 Reactor Safety

*REFER ALSO TO CITATION(S) 38558, 39103, 39359, 39900, 39905*

38944 **(ALO—1018) Study to assess the potential uses of cost/benefit techniques. Final report.** LaChance, J.L.; Moore, D.L.; Rees, D.C. (Energy, Inc., Kent, WA (USA)). May 1983. Contract AC04-76DP00789. 235p. NTIS, PC A15/MF A01. Order Number DE83013139.

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The results of this study to assess potential uses of cost/benefit analysis are derived from application of probabilistic risk assessment (PRA) techniques to two design perspectives. They are (1) the evolution of design, regulation, and plant risk as applied to a representative BWR design, and (2) the risk values associated with various systems or system groups for a baseline BWR design. The PRA techniques were used to develop various quantitative indices of plant risk; these values can then be used with design cost information to derive cost/benefit analysis results. Quantitative results and some of their implications for the utility of cost/benefit analysis within the context of nuclear power plant design and regulation are discussed.

38945 **(EGG-M—02183) Analysis of core physics and thermal-hydraulics results of control rod withdrawal experiments in the LOFT facility.** Varacalle, D.J. Jr.; Chen, T.H.; Harvego, E.A.; Ollikkala, H. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 16p. (CONF-830439—7). NTIS, PC A02/MF A01. Order Number DE83013667.

From 3. multi-phase flow and heat transfer symposium; Miami, FL, USA (18 Apr 1983).

Two anticipated transient experiments simulating an uncontrolled control rod withdrawal event in a pressurized water reactor (PWR) were conducted in the Loss-of-Fluid Test (LOFT) Facility at the Idaho National Engineering Laboratory. The scaled LOFT 50-MW(t) PWR includes most of the principal features of larger commercial PWRs. The experiments tested the ability of reactor analysis codes to accurately calculate core reactor physics and thermal-hydraulic phenomena in an integral reactor system. The initial conditions and scaled operating parameters for the experiments were representative of those expected in a commercial PWR. In both experiments, all four LOFT control rod assemblies were withdrawn at a reactor power of 37.5 MW and a system pressure of 14.8 MPa.

38946 **(EGG-M—03783) PWR response to an inadvertent boron-dilution event.** Adams, J.P.; Gidaspow, D.; Raghavan, V.; Sui, H.D. (EG and G Idaho, Inc., Idaho Falls (USA); Illinois Inst. of Tech., Chicago (USA). Dept. of Chemical Engineering). 1983. Contract AC07-76ID01570. 28p. (CONF-830439—8). NTIS, PC A03/MF A01. Order Number DE83013666.

From 3. multi-phase flow and heat transfer symposium; Miami, FL, USA (18 Apr 1983).

Response of a pressurized water reactor (PWR) to an inadvertent boron-dilution event during refueling was studied experimentally in the Loss-of-Fluid Test (LOFT) facility and in a plexiglass model of the LOFT reactor vessel. These experiments showed that good mixing of the diluent and fluid volumes occurred in the direct-flow-path volumes which are used in simulating residual heat removal (RHR) in a PWR. In addition, other fluid volumes, not in the RHR path, also mixed, delaying the time to criticality beyond that expected based on RHR volumes only.

38947 **(EGG-M—04483) Pressurizer and steam-generator behavior under PWR transient conditions.** Wahba, A.B.; Berta, V.T.; Pointner, W. (EG and G Idaho, Inc., Idaho Falls (USA); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). 1983. Contract AC07-76ID01570. 23p. (CONF-830439—9). NTIS, PC A02/MF A01. Order Number DE83013665.

From 3. multi-phase flow and heat transfer symposium; Miami, FL, USA (18 Apr 1983).

Experiments have been conducted in the Loss-of-Fluid Test (LOFT) pressurized water reactor (PWR), at the Idaho National Engineering Laboratory, in which transient phenomena arising from accident events with and without reactor scram were studied. The main purpose of the LOFT facility is to provide data for the development of computer codes for PWR transient analyses. Significant thermal-hydraulic differences have been observed between the measured and calculated results for those transients in which the pressurizer and steam generator strongly influence the dominant transient phenomena. Pressurizer and steam generator phenomena that occurred during four specific PWR transients in the LOFT facility are discussed. Two transients were accompanied by pressurizer inflow and a reduction of the heat transfer in the steam generator to a very small value. The other two transients were accompanied by pressurizer outflow while the steam generator behavior was controlled.

38948 **(EGG-M—06983) Anticipated transient without scram experiments at LOFT.** Grush, W.H.; Varacalle, D.J. Jr.; Harvego, E.A.; Koizumi, Y. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 32p. (CONF-830489—1). NTIS, PC A03/MF A01. Order Number DE83013673.

From 45. annual meeting of the American Power Conference; Houston, TX, USA (18 Apr 1983).

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Two Anticipated Transient Without Scram (ATWS) experiments Experiments L9-3 and L9-4, were conducted in the Loss-of-Fluid Test (LOFT) pressurized water reactor (PWR). Experiment L9-3 simulated a loss-of-feedwater ATWS in a commercial PWR and Experiment L9-4 simulated a loss-of-offsite power ATWS. The system transient behavior in each experiment was dominated by interaction between the primary-to-secondary heat removal rate in the steam generator and reactor kinetics in the core. The results of the experiments showed that ATWS events can be controlled by properly sized automatic safety systems and that plant recovery can be accomplished (without inserting the control rods) with recovery procedures involving power-operated relief valve (PORV) cycling, secondary system feed and bleed, and boron injection. The system transient response predicted by the RELAP5/MOD1 computer code showed good agreement with the experimental data.

38949 **(EPRI-NP—3086) Evaluation of critical flow for supercritical steam-water. Final report.** Lee, D.H.; Swinnerton, D. (UKAEA Atomic Energy Establishment, Winfrith). May 1983. 154p. NTIS, PC A08/MF A01. Order Number DE83902250.

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Experimental measurements of critical flow of sub-cooled water have been carried out on the Winfrith High Pressure Rig over the pressure range 500 to 4500 psi. Four nozzles have been tested to show the relative characteristics of a 0.07″ diameter square-edged orifice, 0.07″ and 0.10″ diameter rounded inlet parallel throat nozzles and a baffled nozzle having the same minimum flow area as a 0.07″ hole. Measurements have also been made of heat transfer in a 0.466″ diameter tube at nozzle inlet conditions. The report describes the experimental equipment, accuracy of measurements and data processing: 283 experiments are presented in tabular and graphical format and compared against other data and predictions. Critical flow rates have been compared against those predicted by the Homogeneous Equilibrium Model, the Extended Henry Fauske and Modified Burnell models and the Bernoulli equation. The heat transfer data have been compared against the correlations of Dittus-Boelter, Jackson-Hall, and Bishop.

38950 **(KFK—3458) Reliability study for the containment of a pressurezed water reactor using probabilistic fracture mechanics. Pt. 1.** Haeberer, R.; Brueckner, A.; Munz, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Dec 1982. 57p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750679.

A reliability analysis is performed by the methods of probabilistic fracture mechanics for the safety containment of a pressurized water reactor during a loss of coolant accident. This study is based on the results of the project 'BMFT 150 201C'. An important aspect is the analysis of the data collected for this project. A sensitivity study is performed in order to examine the influence of different statistical procedures and different fracture mechanical models. It is shown that the failure probability calculated with the methods of probabilistic fracture mechanics is very small, but due to the existing uncertainties in the model it is impossible to give absolute numbers.

38951 **(NP—3902384) OECD Halden Reactor Project. Twenty-second annual report, 1981.** (Nuclear Energy Agency, 75 - Paris (France)). 1982. 43p. OECD Publications and Information Center, Suite 1207, 1750 Pennsylvania Ave., NW, Washington, DC 20006.

Information is presented concerning HBWR reactor experiments; fuel failure from pellet-cladding interaction; fission product behavior; heat transport in fuels; simulation of LWR conditions; LOCA effects on fuel integrity; fuel performance evaluation and modelling; alarm handling; computer-based operation manuals; core surveillance and control; the role of the operating crew; operator performance; validation of operator aids; retrofitting; process simulators; computer structures; and software reliability.

38952 **(NUREG—0606-Vol.5-No.2) Unresolved safety issues summary: aqua book.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jun 1983. 96p. NTIS, PC A05/MF A01 - GPO. Order Number DE83902165.

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The unresolved safety issues summary is designed to provide the management of the nuclear regulatory commission with a quarterly overview of the progress and plans for completion of generic tasks addressing unresolved safety issues reported to congress pursuant to section 210 of the Energy Reorganization Act of 1974 as amended. The schedules in this book include a milestone at the end of each action plan which represents the initiation of the implementation process both with respect to incorporation of the technical resolution in the NRC official guidance or requirements and also the application of changes to individual operating plants. The schedule for implementation will not normally be included in the task action plan(s) for the resolution of a USI since the nature and extent of the activities necessary to accomplish the implementation cannot normally be reasonably determined prior to the determination of a technical resolution. The progress and status for implementation of unresolved safety issues for which a technical resolution has been completed are reported specifically in a separate table provided in this summary.

38953 **(NUREG—0831-Suppl.4) Safety-Evaluation Report related to the operation of Grand Gulf Nuclear Station, Units 1 and 2. Docket Nos. 50-416 and 50-417.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). May 1983. 158p. NTIS, PC A08/MF A01 - GPO $5.50. Order Number DE83902367.

Supplement 4 to the Safety Evaluation Report for Mississippi Power and Light Company, et. al., joint application for licenses to operate the Grand Gulf Nuclear Station, Units 1 and 2, located on the east bank of the Mississippi River near Port Gibson in Claiborne County, Mississippi, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports the status on the resolution of those issues that required further evaluation before authorizing operation of Unit 1 above 5% rated power and other issues that were to be evaluated during the first cycle of power operation.

38954 **(NUREG—0882-Suppl.1) Safety-Evaluation Report related to the renewal of the operating license for the research reactor at the Armed Forces Radiobiology Research Institute. Docket No. 50-170.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). May 1983. 12p. NTIS, PC A02/MF A01 - GPO $3.00. Order Number DE83902380.

Supplement 1 to the Safety Evaluation Report related to the renewal of the operating license for the research reactor at the Armed Forces Radiobiology Research Institute has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The reactor facility is located in Mont-

gomery County, Maryland. This supplement reports on the status of the licensee's emergency plan that had not been reviewed at the time the Safety Evaluation Report (NUREG-0882) was published.

38955 **(NUREG/CR—2331-Vol.2-No.4) Safety-research programs sponsored by Office of Nuclear Regulatory Research. Quarterly progress report, October 1-December 31, 1982.** Bari, R.A.; Cerbone, R.J.; Ginsberg, T. (Brookhaven National Lab., Upton, NY (USA)). Mar 1983. Contract AC02-76CH00016. 171p. (BNL-NUREG—51454-Vol.2-No.4). NTIS, PC A08/MF A01 - GPO. Order Number DE83013838.

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The projects reported are the following: HTGR Safety Evaluation, SSC Development, Validation and Application, CRBR Balance of Plant Modeling, Thermal-Hydraulic Reactor Safety Experiments, LWR Plant Analyzer Development LWR Code Assessment and Application; Stress Corrosion Cracking of PWR Steam Generator Tubing, Bolting Failure Analysis, Probability Based Load Combinations for Design of Category I Structures, Mechanical Piping Benchmark Problems, Soil Structure Interaction; Human Error Data for Nuclear Power Plant Safety Related Events, Criteria for Human Engineering Regulatory Guides and Human Factors in Nuclear Power Plant Safeguards.

38956 **(NUREG/CR—2607) Fire-protection research program for the US Nuclear Regulatory Commission, 1975-1981.** Dube, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1983. Contract AC04-76DP00789. 106p. (SAND—82-0431). NTIS, PC A06/MF A01 - GPO. Order Number DE83013475.

Since early 1975, Sandia National Laboratories has been conducting fire-protection research for the US Nuclear Regulatory Commission. Testing has been done on grouped electrical-cable fires including electrical initiation, fire propagation, the effects of fire-retardant coatings and barriers, suppression, and characterization of the damage-ability of electrical cables. In addition, several studies of a more-generic nature such as fire detection, ventilation, and fire-hazards analysis methodologies were performed. This report condenses all of the test results, reports, papers, and research findings of the past seven years. Research conducted by contractors to Sandia National Laboratories is also summarized.

38957 **(NUREG/CR—2786) BWR refill-reflood program. Task 4.4 CCFL/refill system effects tests (30° sector): evaluation of ECCS mixing phenomena.** Findlay, J.A. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). May 1983. 70p. (EPRI-NP—2542; GEAP—22150). NTIS, PC A04/MF A01 - GPO $4.50. Order Number DE83902098.

Experiments addressing thermal hydraulic phenomena under Loss-of-Coolant-Accident conditions have been conducted in a full-scale 30° sector mock-up of the BWR. The test program included both steady-pressure and transient LOCA simulation, at system pressure up to ten atmospheres, and addressed both specific thermal hydraulic phenomena and system response under blowdown/refill/reflood conditions. Mixing and condensation effects observed in these experiments are found to make an important contribution to effective system refill/reflood performance. Principal areas of interest are core spray injection leading to localized subcooling in the upper plenum that breaks down counter-current flow limiting at the top of the core, bypass mixing of subcooled ECCS injection and channel-wall heat transfer, and low-pressure-coolant injection leading to subcooling in the lower plenum that reduces liquid flow out the jet pumps. These effects augment plenum refill and core reflood. Other condensing effects identified and evaluated are evidenced by the coupling of upper plenum two-phase level with core spray-injection location, and subcooled side-entry-orifice CCFL.

38958 **(NUREG/CR—3148) Independent assessment of TRAC-PD2 and RELAP5/MOD1 codes at BNL in FY 1981.** Saha, P.; Jo, J.H.; Neymotin, L.; Rohatgi, U.S.; Slovik, G. (Brookhaven National Lab., Upton, NY (USA)). Dec 1982. Contract AC02-76CH00016. 131p. (BNL-NUREG—51645). NTIS, PC A07/MF A01 - GPO. Order Number DE83013653.

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This report documents the independent assessment calculations performed with the TRAC-PD2 and RELAP/MOD1 codes at Brookhaven National Laboratory (BNL) during Fiscal Year 1981. A large variety of separate-effects experiments dealing with (1) steady-state and transient critical flow, (2) level swell, (3) flooding and entrainment, (4) steady-state flow boiling, (5) integral economizer once-through steam generator (IEOTSG) performance, (6) bottom reflood, and (7) two-dimensional phase separation of two-phase mixtures were simulated with TRAC-PD2. In addition, the early part of an overcooling transient which occurred at the Rancho Seco nuclear power plant on March 20, 1978 was also computed with an updated version of TRAC-PD2. Three separate-effects tests dealing with (1) transient critical flow, (2) steady-state flow boiling, and (3) IEOTSG performance were also simulated with RELAP5/MOD1 code. Comparisons between the code predictions and the test data are presented.

38959 **(NUREG/CR—3152) Correlation of the analytical solution with experimental data on the electrolysis-potential probe.** Bethmann, W.F. Jr. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 60p. (ORNL/TM—8650). NTIS, PC A04/MF A01 - GPO. Order Number DE83013811.

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In response to a loss of coolant accident (LOCA) in a water-cooled nuclear reactor, the reactor vessel is reflooded with water from standby storage tanks to carry off heat that would otherwise damage fuel rods, vessel, and other structures. During the latter phases of the reflooding, a mixture of steam and water flows between the structures and a flowing film of water adheres to the surfaces. To gain some knowledge about the behavior of these films and to aid heat transfer calculations in designing reactors, engineers have developed instruments for the measurement of film thickness, flow velocities, and mass flow rate in reactors and their simulators. The electrolysis potential (EP) probe is one such instrument and is designed to measure average liquid velocity inside the films. Development of the EP probe is based on the concept that current between the two electrodes of a sensor in contact with a water film will vary inversely with fluid velocity when an excitation voltage of sufficient magnitude to produce visible electrolysis is applied. The EP probe was capable of measuring liquid film velocities over the range from 5 to 50 cm/s with an accuracy of ~ +- 5% of reading under laboratory conditions.

38960 **(NUREG/CR—3163) RELAP5 assessment: LOFT small-break L3-6/L8-1.** Kmetyk, L.N. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1983. Contract AC04-76DP00789. 83p. (SAND—83-0245). NTIS, PC E05/MF A01 - GPO. Order Number DE83013481.

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The RELAP5 independent assessment project at Sandia National Laboratories is part of an overall effort funded by the NRC to determine the ability of various systems codes to predict the detailed thermal/hydraulic response of LWR's during accident and off-normal conditions. The RELAP5 code is being assessed at SNLA against test data from various integral and separate effects test facilities. As part of this assessment matrix, a small break transient and subsequent partial core uncovery transient performed at the LOFT facility have been analyzed. The results show that RELAP5/MOD1 does very well on predicting the qualitative behavior for this small break experiment, although there are a number of quantitative disagreements.

38961 **(NUREG/CR—3239) COMPBRN: a computer code for modeling compartment fires.** Siu, N.O. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). May 1983. 110p. (UCLA-ENG—8257). NTIS, PC A06/MF A01 - GPO $4.75. Order Number DE83902329.

The computer code COMPBRN deterministically models the behavior of fire in a compartment. This manual presents information necessary to run COMPBRN, including descriptions of required input and resulting output. Also included are a sample problem and a listing of the code (written in FORTRAN for an IBM

3033 computer). This manual is to be used in conjunction with NUREG/CR-2269, Probabilistic Models for the Behavior of Compartment Fires, August 1981, which describes the fire models employed by COMPBRN.

38962 **(PNL-SA—11075) Scenario guidance handbook for emergency-preparedness exercises at nuclear facilities.** Laughlin, G.J.; Martin, G.F.; Desrosiers, A.E. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76RL01830. 5p. (CONF-830609—18). NTIS, PC A02/MF A01. Order Number DE83013756.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

As part of the Emergency Preparedness Implementation Appraisal Program conducted by the Nuclear Regulatory Commission (NRC) with the technical assistance of the Pacific Northwest Laboratory (PNL), emergency preparedness exercises are observed on an annual basis at all licensed reactor facilities. One of the significant findings to arise from these observations was that a large number of the commonly observed problems originated in the design of the scenarios used as a basis for each exercise. In an effort to help eliminate some of these problems a scenario guidance handbook has been generated by PNL for the NRC to assist nuclear power plant licensees in developing scenarios for emergency preparedness exercises.

38963 **(PNL-SA—11277) Emergency preparedness in the future.** Desrosiers, A.E. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1983. Contract AC06-76RL01830. 8p. (CONF-830553—1). NTIS, PC A02/MF A01. Order Number DE83012796.

From Health Physics Society Chapter meeting; Richland, WA, USA (1 May 1983).

This speech discusses safety issues facing nuclear power generation in terms of their contribution to increased costs of construction. The view is advanced that improvements in regulatory methods could be achieved by improvements in probabilistic risk assessment. The major deficiency in risk assessment is that the consequence assessments are not realistic and accident consequences not well understood. It is demonstrated that realistic modelling of evacuation times and other emergency preparedness capabilities can significantly reduce the calculated risk of operating nuclear power plants. (ACR)

38964 **(UCID—19810) Evaluating the effects of seismic events on systems in a nuclear facility using the Σ PI method.** Thatcher, R.M. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 64p. NTIS, PC A04/MF A01. Order Number DE83013705.

This report describes an application of the Σ-PI method to a seismic safety problem. The Σ-PI method is a very recent advance in probabilistic modeling and computation. It simplifies the computation of failure probabilities of large systems such as power plant systems in the seismic safety problem which SEISIM, an existing model, evaluates. For such systems, using no more computer resources, Σ-PI calculates estimates of system failure probabilities, whereas SEISIM calculates upper bounds to its estimators of the same probabilities. Σ-PI is actually two methods, Σ and PI. PI is a modeling technique which leads to fast and accurate calculations of cut set probability estimators. PI can evaluate large cut sets of dependent basic events without difficulty, whereas SEISIM is drastically limited by the rapid acceleration of computer requirements with respect to cut set size. The Σ-PI method described in this report has been implemented and tested and is now available for merging with existing seismic safety computer codes.

38965 **Three Mile Island - the challenge, the saga, the outlook.** Coffman, F.E.; Feinroth, H. (Department of Energy, Washington, DC (USA)). *Nuclear Energy (Institution of Nuclear Engineers);* **21**: No. 6, 365-369(Dec 1982).

Progress which has been made in tackling some of the problems raised by the accident at Three Mile Island 2 is discussed. Improvements in the design, operation, management and regulation of nuclear plants are described. An assessment is given of the challenge facing the nuclear industry to explain the accident to the public and to demonstrate that a catastrophe was never close since significant barriers still existed to prevent major releases of radioactivity. The job of cleaning up the contaminated plant is described and the lessons to be learnt from this task are outlined.

38966 **Coupling effect between liquid sloshing and flexible fluid-filled systems.** Liu, W.K. (Northwestern Univ., Evanston, IL (USA). Dept. of Mechanical and Nuclear Engineering); Ma, D.C. (Argonne National Lab., IL (USA). Reactor Analysis and Safety Div.). *Nuclear Engineering and Design;* **72**: No. 3, 345-357(Oct 1982).

Current practice in seismic design of flexible liquid-filled systems is reviewed. A coupled fluid-structure finite element method which considers the sloshing effect is developed for the seismic analysis of liquid-filled systems of various geometries with and without internal components. An analysis of the dynamic interaction between the structural vibration and liquid sloshing is also presented. Both rigid and flexible fluid-tank systems of different configurations are considered. Results demonstrate that tank flexibility can affect the amplitude of the free surface wave and hence the sloshing pressure and structural response. This result is consistent with the perturbation analysis. The dynamic interaction depends on (1) the ratio of natural frequency between fluid sloshing and the fluid-tank system and (2) the ratio of the effective areas of the fluid-structure interface and free surface of the fluid. Hence it is expected that in analyzing tanks with flexible internal components, this coupling effect can be more pronounced.

38967 **Probabilistic risk assessment, Volume I.** La Grange Park, IL; American Nuclear Society, Inc. (1982). 518p. (CONF-810905—).

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

This book contains 158 papers presented at the International Topical Meeting on Probabilistic Risk Assessment held by the American Nuclear Society (ANS) and the European Nuclear Society (ENS) in Port Chester, New York in 1981. The meeting was second in a series of three. The main focus of the meeting was on the safety of light water reactors. The papers discuss safety goals and risk assessment. Quantitative safety goals, risk assessment in non-nuclear technologies, and operational experience and data base are also covered. Included is an address by Dr. Chauncey Starr.

38968 **Proportional hazards models for improving the analysis of light water reactor component failure data.** Booker, J.B. (Los Alamos National Lab., NM); Johnson, M.E.; Easterling, R.G. pp 202-211 of Probabilistic risk assessment. La Grange Park, IL; American Nuclear Society, Inc. (1982). (CONF-810905—).

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

The reliability of a power plant component may depend on a variety of factors (or covariates). If a single regression model can be specified to relate these factors to the failure rate, then all available data can be used to estimate and test for the effects of these covariates. One such model is a proportional hazards function that is specified as a product of two terms: a nominal hazard rate that is a function of time and a second term that is a function of the covariates. The purpose of this paper is to adapt two such models to LWR valve failure rate analysis, to compare the results, and to discuss the strengths and weaknesses of these applications.

38969 **Loss of offsite power in pressurized water reactors, a combined probablistic and thermal-hydraulic analysis.** Fletcher, C.D.; Bruske, S.J. (EG & G Idaho, Inc., Idaho Falls). pp 225-234 of Probabilistic risk assessment. La Grange Park, IL; American Nuclear Society, Inc. (1982). (CONF-810905—). Contract AC07-76ID01570.

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

The pressurized water reactor (PWR) loss of offsite power initiating event was studied at the Idaho National Engineering Laboratory as a part of the U.S. Nuclear Regulatory Commission's (NRC) Severe Accident Sequence Analysis Program. An event tree was developed and used as a basis for investigating high risk accident sequences initiated by a loss of offsite power. Specific high risk accident sequences for further study were determined by assigning probabilities to events within the tree. The thermal-hydrau-

lic responses of three PWRs of different vendors were calculated for these high risk sequences using the RELAP4/MOD7 computer code. Actions to mitigate the consequences of certain sequences were identified and the critical times for their implementation were determined.

**38970 Severe accident sequence assessment of hypothetical complete station blackout at a BWR4/Mark I nuclear plant.** Yue, D.D. (Oak Ridge National Lab., TN); Condon, W.A. pp 235-244 of Probabilistic risk assessment. La Grange Park, IL; American Nuclear Society, Inc. (1982). (CONF-810905—). Contract W-7405-ENG-26.

From ANS/ENS topical meeting on probabilistic risk assessment; Post Chester, NY, USA (20 Sep 1981).

Various severe accident sequences have been investigated which may occur following a complete station blackout at a BWR4/Mark I nuclear plant. The investigation was performed for the Browns Ferry Nuclear Plant, and all accident sequences resulted in a hypothetical core meltdown. Calculations were performed with the MARCH code modified to include the actinide decay power to produce better agreement with KESS code. This change in decay power resulted in shortening the time before core uncovery by ~18%, and reducing the time before the start of core melting by ~26%. Following the hypothetical core meltdown accident, the drywell electric penetration assembly seals have been identified as the most likely leak pathway outside the containment. This potential mode of containment failure is predicted to occur at a pressure ~30% lower than that set forth in the Reactor Safety Study.

**38971 Decay heat removal and natural convection in fast breeder reactors.** Aqrawal, A.K.; Guppy, J.G. (eds.). Washington, DC; Hemisphere Publishing Corp. (1981). 423p. Hemisphere Publishing Corp., Washington, DC/$55.00.

This book contains the full texts of the papers presented at a specialists meeting on fast reactor fission product decay heat removal by heat transport systems operated solely by the forces of natural convection. The meeting was sponsored by the American Nuclear Society and held at Brookhaven National Laboratory, February 28 and 29, 1980. The meeting was just 1 month before the first anniversary of the TMI-2 accident (which in a fundamental sense was caused by a temporary failure to remove decay heat), so the contributors felt that their topics were particularly pertinent, even though they were concerned with decay heat removal from another type of reactor. The 27 papers are predominantly about natural convection in liquid metal heat transport systems (since all operating fast power reactors are cooled by liquid sodium). The only exception is a set of three papers about gas cooled fast reactors. In all of the papers, the atmosphere furnishes the ultimate heat sink, so one finally needs to be concerned about natural convection in air. However, this is a relatively well-understood process and nearly all of the attention of the contributors is devoted to the heat transfer processes in the around the reactor core.

**38972 Failure modes for concrete nuclear containment buildings.** Bulter, T.A. (Los Alamos National Lab., NM). pp 23-29 of Advances in containment design and analysis. Bernstein, M.D.; Iotti, R.C.; Von Riesemann, W.A. (eds.). New York, NY; The American Society of Mechanical Engineers ([nd]).

The failure modes and associated failure pressures for two common generic types of PWR containments are predicted. One building type is a lightly reinforced, posttensioned structure represented by the Zion nuclear reactor containment. The other is the normally reinforced Indian Point containment. Two-dimensional models of the buildnga developed using the finite element method are used to predict the failure modes and failure pressures. Predicted failure modes for both containments involve loss of structural integrity at the intersection of the cylindrical sidewall with the base slab.

# 25 ENERGY STORAGE

## 2502 Compressed Gas

**38973 (PNL—4743) Reservoir characterization and final pre-test analysis in support of the compressed-air-energy-storage Pittsfield aquifer field test in Pike County, Illinois.** Wiles, L.E.; McCann, R.A. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76RL01830. 61p. NTIS, PC A04/MF A01. Order Number DE83013908.

The work reported is part of a field experimental program to demonstrate and evaluate compressed air energy storage in a porous media aquifer reservoir near Pittsfield, Illinois. The reservoir is described. Numerical modeling of the reservoir was performed concurrently with site development. The numerical models were applied to predict the thermohydraulic performance of the porous media reservoir. This reservoir characterization and pre-test analysis made use of evaluation of bubble development, water coning, thermal development, and near-wellbore desaturation. The work was undertaken to define the time required to develop an air storage bubble of adequate size, to assess the specification of instrumentation and above-ground equipment, and to develop and evaluate operational strategies for air cycling. A parametric analysis was performed for the field test reservoir. (LEW)

## 2506 Thermal

*REFER ALSO TO CITATION(S) 39035*

**38974 (EUR—7703-EN) Heat storage using latent heat of fusion of a substance adsorbed on a porous supporting material.** Ronc, M.; Bollon, F. (Commission of the European Communities, Luxembourg. Directorate-General for Research, Science and Education). 1982. 90p. Commission of the European Communities, Luxembourg.

The results are very positive with respect to thermal efficiency. Increased storage capacities are possible with the present process as compared to water tanks (by a factor 1.5 at temperatures around 50 to 60°C) and pebble beds (up to 3.7 times between 50°C and 60°C) with a dynamic behaviour very close to that of a perfectly stratified tank and with acceptable pressure drops. Very high internal heat transfer efficiency is also obtained when water is used as the heat transfer fluid. However, a major doubt still remains about the feasibility of the process because of long term stability problems. This problem could not be solved in the frame of the present work and necessitates a detailed analysis of the adsorption mechanism of paraffin on porous particles (activated carbon or others).

## 2509 Batteries

*REFER ALSO TO CITATION(S) 38866*

**38975 (CONF-8305100—1-Rev.) Cell-design principles for the measurement of kinetics of fast-electrode reactions.** Nagy, Z.; Settle, J.L. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01. Order Number DE83011652.

From 4. Electrochemical Society international symposium on molten salts; Pennington, NJ, USA (8 May 1983).

The rates of electrode processes in high-temperature molten salts are often very fast and special precautions are needed in their measurements. The measurement methods are invariably some sort of relaxation technique where a fast perturbation of the current (or the potential) is applied and the resulting potential (or current) relaxation is recorded. The measuring cells used in these experiments have to be carefully designed so that the distortion of the fast electrical signals and the introduction of spurious signals are avoided. The two requirements of a good cell design can be simply stated as: (1) the assurance of uniform current distribution on the working-electrode surface, and (2) small impedance. The latter requirement includes small stray capacitances and small inductance, which are necessary to avoid detrimental phase shifts and inductive spikes in the signal, and small ohmic resistance of the solution between the

reference and the working electrodes. Three cell designs, aimed at fulfilling these requirements, are described.

38976 **(DOE/ER—0168) Report of the research assistance task force on beta-alumina for sodium-sulfur batteries.** (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Jun 1983. 20p. (CONF-830370—Summ.). NTIS, PC A02/MF A01. Order Number DE83013616.

From Beta-alummina for sodium-sulfur batteries meeting; Oak Ridge, TN, USA (8 Mar 1983).

The meeting reported was structured to concentrate on the fundamental properties of various beta-aluminas and the processing of these materials to form an electrolyte so that critical issues relating to improved performance, lifetime, and reducing costs could be identified. The discussions concentrated on beta form of sodium aluminate materials as the material of choice for use in sodium-sulfur batteries. The meeting focussed on fundamental aspects, defects and degradation, processing and sintering, and battery systems. (LEW)

38977 **(LBL—15517) High-specific-energy secondary batteries and their applications.** Cairns, E.J. (Lawrence Berkeley Lab., CA (USA)). Jan 1983. Contract AC03-76SF00098. 17p. (CONF-830486—1). NTIS, PC A02/MF A01. Order Number DE83012877.

From Electro '83 electronic show and convention; New York, NY, USA (19 Apr 1983).

The state of development, problems, and possible ipplications are discussed for a number of rechargeable cells, including: lead/lead dioxide, cadmium/nickel oxide, hydrogen/nickel oxide, iron/nickel oxide, zinc/nickel oxide, zinc/silver oxide, zinc/halogen, lithium/titanium disulfide, lithium/iron sulfide, and sodium/sulfur cells. (LEW)

38978 **(N—8314667) Electromagnetic studies of redox systems for energy storage.** Wu, C.D.; Scherson, D.; Yeager, E. (Case Western Reserve Univ., Cleveland, OH (USA)). Nov 1981. 69p. (NASA-CR—169593). NTIS, PC A04/MF A01.

Both chromium and iron couples were studied on various electrode surfaces in acidic perchlorate solution by using rotating ring-disk techniques. It was found that chloride which forms inner sphere coordination complexes with the redox species enhances the electrode kinetics dramatically. The effects of lead underpotential deposition and surface alloy formation on the kinetics of the chromium couple on gold were studied using both linear sweep voltammetry and potential step techniques. The lead underpotential deposition was found to slow down the kinetics of the reduction of the Cr species on gold surfaces although increase the hydrogen overvoltage. The effect on the chromium kinetics can be explained in terms of principally a double layer effect. The underpotential deposition lead species with its positive charge results in a decrease in the concentration of the Cr species at the electrode surface. Similar phenomena were also observed with bismuth underpotential deposition on gold for the iron couple.

38979 **(N—8314684) Lithium/sulfur dioxide cell and battery safety.** Halpert, G.; Anderson, A. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Nov 1982. 19p. (NASA-RP—1099). NTIS, PC A02/MF A01.

The new high-energy lithium/sulfur dioxide primary electrochemical cell, having a number of advantages, has received considerable attention as a power source in the past few years. With greater experience and improved design by the manufacturers, this system can be used in a safe manner provided the guidelines for use and safety precautions described herein are followed. In addition to a description of cell design and appropriate definitions, there is a safety precautions checklist provided to guide the user. Specific safety procedures for marking, handling, transportation, and disposal are also given, as is a suggested series of tests, to assure manufacturer conformance to requirements.

38980 **(UCRL—53382) Design analysis of an aluminum-air battery for vehicle operations. Transportation systems research.** Behrin, E.; Wood, R.L.; Salisbury, J.D.; Whisler, D.J.; Hudson, C.L. (Lawrence Livermore National Lab., CA (USA)). 18 Mar 1983. Contract W-7405-ENG-48. 145p. NTIS, PC A07/MF A01. Order Number DE83014488.

The objective of the study reported was to perform a detailed configuration analysis of an aluminum-air battery, evaluate various automobile propulsion systems utilizing the Al-air battery, and estimate the performance and cost of vehicles incorporating these propulsion systems. A preliminary engineering design is performed. A physical model and a cell-performance model of a conceptual mass-produced Al-air battery were constructed and work together to characterize the battery system. The physical battery model is based on a specific battery design concept and defines the mass and volume of a complete Al-air battery system. The cell-performance model simulates the electrical and electrochemical characteristics of the battery. The physical model and two versions of the cell-performance model - near-term and optimistic - were used in a vehicle-conversion analysis to evaluate three automotive propulsion systems - Al-air battery only, Al-air battery/secondary battery, and Al-air battery/flywheel. (LEW)

# 29 ENERGY PLANNING AND POLICY

*REFER ALSO TO CITATION(S) 39887*

## 2902 Economics And Sociology

*REFER ALSO TO CITATION(S) 38426, 38428, 38456, 38457, 38506, 38583, 38591, 38602, 38927, 39003, 39387*

38981 **(DOE/PE/70047—T6) Development of a research plan for analysis of desubsidization. Task assignment No. 4. Final report.** (Technology and Economics, Inc., Cambridge, MA (USA)). 19 Sep 1980. Contract AC01-79PE70047. 38p. NTIS, PC A03/MF A01. Order Number DE83013878.

The purpose of this paper is to establish the conceptual foundations necessary for an analysis of the impact of subsidies on conventional energy sources. Basically, it is argued that an analysis of the economic significance of subsidy programs must be preceded by an understanding of the factors necessary for obtainment of socially optimal prices and outputs in the relevant markets. Section 2 discusses background considerations regarding the issue of desubsidization. Section 3 addresses the market factors that may lead to a divergence of private from social costs and delineate the different types of public programs and policies utilized for market-intervention purposes. Section 4 contains a treatment of the analysis of subsidies in a competitive market and a brief consideration of the implications of general equilibrium. In Section 5.0 the issues of intertemporal allocation and world markets as they pertain to nonrenewable energy sources are considered. Finally, in Section 6.0 conclusions are presented with an assessment of the feasibility of future work in this area.

38982 **(FE—2517-3) Capital budgeting extension to the econergy portfolio model. Econery report No. 1-704.** English, J.M. (Econergy, Inc., Los Angeles, CA (USA)). Feb 1977. Contract AC01-76ET12316. 38p. NTIS, PC A03/MF A01. Order Number DE83013455.

This report provides a simplified and practical tool for determining the schedule for capital allocations needed to implement a desired portfolio of energy projects. The Econergy portfolio model is a tool for determining what set of plants or processes will be best from the ERDA point of view. However, implementation of an engineering and construction program to obtain that portfolio will need to be scheduled in such a way as to keep within budget constraints determined by governmental policy. This means that schedules for various projects will need to be slipped in time. The Econergy capital budgeting technique provides a suitable means for doing this, thereby ensuring an optimal portfolio. An example problem was worked out in some detail to demonstrate the methodology. A more sophisticated, computerized extension of this method

could be developed and then be used in conjunction with the Econergy portfolio model.

**38983 (GAO/RCED—83-2) Federal Energy Regulatory Commission makes progress toward expanding user-fee program.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 9 Feb 1983. 24p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

The Federal Energy Regulatory Commission is committed to become as self-sustaining as possible over the next several years. To accomplish this, it is expanding the amounts of fees collected from oil pipeline, electric, and natural gas companies which use FERC's services. These fees, which FERC estimates could reach $58 million annually, are known as user fees. While FERC is aggressively developing and implementing this program, GAO believes that its methods and systems for cost estimating and allocation could be strengthened. FERC has agreed and has initiated corrective actions.

## 2903 Environment, Health, And Safety

*REFER ALSO TO CITATION(S) 38460, 38603, 38997, 39004, 39341, 39363, 39387, 39388*

**38984 (CONF-830566—1) Assessing impacts of energy projects on prime farmland.** Reed, R.M.; Voorhees, L.D.; Sharples, F.E. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 23p. NTIS, PC A02/MF A01. Order Number DE83012591.

From ENERGY '83 symposium; San Francisco, CA, USA (16 May 1983).

The loss of prime farmland has been recognized as an issue of national concern. Large energy projects have a high potential for contributing to such loss. Federal and state agencies responsible for environmental approval of energy projects have begun to include analyses of this issue in project-related documents, but these analyses generally provide few comparative data to assess the significance of project impacts. Agencies typically conclude that the loss of prime farmland for individual projects is insignificant in relation to the large size of the resource on a statewide or nationwide basis. As an approach to improving the quality of analyses on prime farmland this paper discusses the types of information needed to assess the significance of project impacts objectively. Consistent use of soil inventory data on prime farmland, agricultural data on crop production, and data on the amount and rate of prime farmland loss to other types of development would greatly improve the quality of these analyses.

**38985 (TVA/ONR/ERD—82/1) Environmental research and development.** Iwanski, M.L. (Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources). Sep 1982. 26p. NTIS, PC A03/MF A01. Order Number DE83902006.

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TVA's interdisciplinary approach to environmental research and development is summarized. Efforts cover air pollution control, water quality control, strip mine reclamation, acid rain effects, and effects of thermal-effluent discharges from power plants. (PSB)

## 2904 Natural Resources

*REFER ALSO TO CITATION(S) 38981, 39389*

**38986 (PB—83-177568) Minerals Yearbook, centennial edition 1981. Volume I. Metals and minerals.** (Bureau of Mines, Washington, DC (USA)). Jan 1983. 939p. NTIS, PC A99/MF E04.

This edition of the Minerals Yearbook Marks the centennial of the first annual publication of comprehensive mineral industry statistics by the Federal Government. This volume of the Minerals Yearbook, covering metals and minerals, contains 71 commodity or commodity group chapters with data on approximately 90 minerals that were obtained as a result of the mineral information gathering activities of the Bureau of Mines. In addition, the volume contains a chapter on mining and quarrying trends and a statistical summary.

## 2905 Research, Development, Demonstration, And Commercialization

**38987 (EPRI-RA—2732-SR) Research results and applications.** (Electric Power Research Inst., Palo Alto, CA (USA). Research Applications Program). Apr 1983. 333p. NTIS, PC A15/MF A01. Order Number DE83902326.

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This report presents 70 exhibits of products of EPRI research that have been beneficially adopted by electric utilities, have seen significant supplier interest, or are extensions and improvements to the original product. It also describes 115 available useful products (formally called new near-term accomplishments) that are ready for utility, vendor, manufacturer or A-E application. These examples cover the entire spectrum of electric R & D: (1) fuel processing; (2) electric power generation; (3) transmission and distribution; (4) energy storage and management; (5) energy analysis; and (6) environmental assessment and control.

**38988 (GAO/AFMD—83-38) Internal-control weaknesses at Department of Energy research laboratories.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 15 Dec 1982. 55p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Chairman, Permanent Subcommittee on Investigations, Senate Committee on Governmental Affairs by the Comptroller General of the United States.

Two requests were made by Chairman, Permanent Subcommittee on Investigations, Senate Committee on Governmental Affairs, that GAO review the vulnerability of selected Department of Energy (DOE) research facilities to fraud, waste, and abuse. The review examined internal controls over payroll, procurement, and property management at six government-owned, contractor-operated (GOCO) research laboratories (Sandia, Hanford, Argonne, Oak Ridge, Fermi, and Brookhaven) and four government-owned, government-operated energy technology centers (Bartlesville, Laramie, Morgantown, and Pittsburgh). In fiscal 1982, DOE budgeted over $3 billion for its GOCO facilities and over $230 million for its energy technology centers. GAO noted specific problems at a number of the laboratories in each of the areas covered. In many instances, DOE has acknowledged the problems and corrective action is underway or is planned.

## 2906 Nuclear Energy

*REFER ALSO TO CITATION(S) 38426, 38506, 38509, 38525, 38528, 38529, 38530, 38875, 38898, 38899, 38902, 38915, 38921, 38925, 38926, 38927, 38962*

**38989 (PNL—4239-Ed.2) Nuclear fact book.** Hill, O.F.; Platt, A.M.; Robinson, J.V. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 192p. NTIS, PC A09/MF A01. Order Number DE83013970.

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This reference provides significant highlights and summary facts in the following areas: general energy; nuclear energy; nuclear fuel cycle; uranium supply and enrichment; nuclear reactors; spent fuel and advanced repacking concepts; reprocessing; high-level waste; gaseous waste; transuranic waste; low-level waste; remedial action; transportation; disposal; radiation information; environment; legislation; socio-political aspects; conversion factors; and a glossary. (GHT)

## 2908 Waste Heat Utilization

*REFER ALSO TO CITATION(S) 39065*

**38990 Energy cogeneration: historical background, present status, and prospects.** Lovin, G.H. (International Cogeneration Society, 111 19th Street, N.W., Suite 1075, Washington, DC 20036). *Transactions of the American Nuclear Society;* **43**: 32(1982). (CONF-821103—).

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

**38991 Cogeneration technology.** Freedman, S.J. (U.S. Department of Energy, Washington, DC 20545). *Transactions of the American Nuclear Society;* **43**: 32-33(1982). (CONF-821103—).

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

**38992 Cogeneration and the utilities: utility policies and programs.** Limaye, D. (Synergic Resources Corporation, One Bala Cynwyd Plaza, Suite 630, Bala Cynwyd, PA 19004). *Transactions of the American Nuclear Society;* **43**: 33(1982). (CONF-821103—).

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

## 2910 Conservation

*REFER ALSO TO CITATION(S) 39026, 39027, 39048, 39050*

## 2920 Supply, Demand, And Forecasting

*REFER ALSO TO CITATION(S) 38455, 38998*

**38993 DOD energy supplies: can they meet the challenge of a future war?.** Hardin, E.C.; Barattino, W.J.; Freiwald, J.G. (U.S. Department of Energy, Albuquerque Operations Office, P.O. Box 5400, Albuquerque, NM 87115). *Transactions of the American Nuclear Society;* **43**: 22-23(1982). (CONF-821103—).

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

**38994 DOD energy alternatives and transitions.** Freiwald, D.A.; Hathaway, S.J.; Poe, B. (MRJ, Inc., 10400 Eaton Place, Suite 300, Fairfax, VA 22030). *Transactions of the American Nuclear Society;* **43**: 23-24(1982). (CONF-821103—).

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

## 2930 Policy, Legislation, And Regulation

*REFER ALSO TO CITATION(S) 38456, 38529, 38927, 39003, 39005, 39066*

**38995 (CONF-8205189—1) Process of community energy planning.** Schweitzer, M. (Oak Ridge National Lab., TN (USA)). Nov 1982. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE83012562.

From National planning conference; Dallas, TX, USA (8 May 1982).

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Community energy planning is the process of envisioning a desired future state of energy supply and consumption for a local area and designing the appropriate measures to implement that energy future. A number of energy planning methodologies have been utilized in recent years, most notably the Hittman Associates Methodology used in the Comprehensive Community Energy Management Program (CCEMP), the assessment-planning methodology developed for the Decentralized Solar Energy Technology Assessment Program (DSETAP), and the county energy planning model developed by Jim Benson and Alan Okagaki of the Institute for Ecological Policies. Simple program planning has also been used in connection with many local energy projects, and contingency planning has been widely used to prepare for energy supply interruptions. Several striking similarities exist between energy planning, which is relatively new, and the much more established practice of community comprehensive planning. A number of opportunities exist for communities seeking to deal with energy issues but lacking the resources to initiate a full-scale energy planning effort. These include using existing personnel to compile an energy data base, creating citizens' energy advisory boards to work with elected officials and stimulate local energy awareness, and examining existing community goals and objectives for their effects on local energy production and use. For communities wishing to launch a more extensive energy planning effort, a hybrid approach is suggested which utilizes elements of comprehensive and program planning to develop a local energy plan.

**38996 (GAO/RCED—83-52) Synthetic Fuels Corporation's use of an expert panel and a staff assistance agreement.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 2 Feb 1983. 18p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Chairman, Committee on Energy and Natural Resources, United States Senate.

The Chairman of the Senate Committee on Energy and Natural Resources requested that GAO review the propriety and evolution of the United States Synthetic Fuels Corporation's (SFC's) use of an expert advisory panel and the corporation's staff assistance agreement with the Environmental Protection Agency. GAO found nothing to indicate that either the use of the panel or the agreement with the Environmental Protection Agency was unauthorized under the Energy Security Act. GAO believes, however, that an earlier announcement of the formation of the panel to the SFC board and executives and earlier direction to panel members on the useful scope of the panel's deliberations would have been more prudent.

**38997 (GAO/RCED—83-75) Potential impacts of reducing the Environmental Protection Agency's budget.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 30 Dec 1982. 71p. U.S. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

EPA proposed to reduce its fiscal year 1983 operating budget by 12 percent to $96 million (excludes funds for Construction Grants and the Hazardous Waste Response Trust Fund). This represents a reduction of $125 million fiscal year 1982. Passage of EPA's fiscal year 1983 appropriation on September 30, 1982, at only a 4-percent decrease (for operating programs) from the 1982 appropriation reduced many of the anticipated impacts of the proposed 1983 budget reductions. However, information on these predicted impacts is presented in the report so that analogies can be drawn of budget cuts are proposed in future years. This report also addresses issues which transcend the fiscal year 1983 proposed budget, including the long-range implications of reductions to State grant assistance, the evolving Federal/State partnership and its role in achieving environmental goals, and the use of permit fees/user charges to replace Federal funding.

## 2940 Fossil Fuels

*REFER ALSO TO CITATION(S) 38336, 38395, 38426, 38428, 38453, 38454, 38454, 38455, 38456, 38457, 38467, 38983, 38983, 38987, 39009, 39009, 39009, 39453*

**38998 (DOE/EI/19622—T1) No. 2 heating oil price survey for Wisconsin 1982-1983 heating season. Final report.** Mapp, J.H.; Gronert, K. (Wisconsin Dept. of Administration, Madison (USA). Div. of State Energy). 31 May 1983. Contract FG01-82EI19622. 20p. NTIS, PC A02/MF A01. Order Number DE83013101.

This report summarizes No. 2 heating oil data for Wisconsin collected from October 1982 to May 1983, by the Wisconsin Division of State Energy (DSE) in accordance with provisions of a grant by the US Department of Energy. The DSE regularly surveyed a representative sample of fuel oil dealers in Wisconsin to provide the State and the US Department of Energy with a current, consistent and reliable set of monthly figures on No. 2 fuel oil prices to residential users and end of month inventory data. To assist in the current survey, the US Department of Energy provided a list of companies for the sample, estimation formulas, sample survey forms and other technical assistance. The survey has provided the DSE with information about price changes and price

projections and estimations of available inventory. The sample consists of 36 of the 79 companies comprising the list provided by the US Department of Energy. Sampling weights provided by the US Department of Energy were used to compute statewide average prices and changes in inventory. The nonrandom, small size of the sample may limit the expected statistical accuracy of reported prices and inventories. Despite its limitations, the survey does provide an indication of relative trends over this heating season.

38999 **(GAO/EMD—82-130) FERC's proposed 1983 budget for the Trans-Alaska Pipeline System case.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 30 Sep 1982. 16p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

The need for continued participation by Federal Energy Regulatory Commission's (FERC) staff in the Trans-Alaska Pipeline System (TAPS) case in fiscal year 1983 is not clear-cut and the effects of terminating staff's participation at this time are uncertain. The direct benefits to the public outside the State of Alaska of reduced tariffs to the pipeline companies are minimal since the transportation costs do not affect the prices charged to consumers of the petroleum products. There may be an indirect benefit to the general public, however, since it appears that there is a potential for increased windfall profits tax revenues if tariffs are reduced and that potential could be enhanced if FERC is allowed to present its testimony supporting reduced TAPS costs. The impact on future exploration and development of additional Alaskan oil is judgmental. However, ratemaking precedents will almost certainly be set, possibly in both Phase I and II decisions. Therefore, FERC's assumed role as a balancing third-party element that provides a complete hearing record on which Phase II decisions will be made could possibly be justified, primarily because it undertook the development of certain relevant issues in lieu of the intervenors developing them. If FERC's continued participation in the case is determined to be beneficial, the need for all of the requested $1.4 million is questionable. Contractor costs of $500,000 appear to be high given the current status of the case and the extensive contractor efforts that have already been funded in prior years. The $900,000 for FERC staff costs also appear high given the amount of work that will have been completed by the end of fiscal year 1982 and the potential for completing FERC's cross-examination by early 1983, which should ensure that their findings are included in the hearing record.

39000 **(GAO/PLRD—83-12) Used-oil collection and disposal practices followed by federal agencies.** (General Accounting Office, Washington, DC (USA). Procurement, Logistics, and Readiness Div.). 3 Dec 1982. 23p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

The used oil collection, storage, and disposal practices at 9 vehicle and equipment maintenance shops operated by 4 agencies in the New York City area. Earlier reviews were made in the Cincinnati, Ohio, San Antonio, Texas, and Washington, DC, areas. Little or no specific guidance had been provided. In most cases agencies were selling or giving their used oil to collectors.

39001 **(GAO/RCED—83-95) Some small-purchase procurements at the Federal Energy Regulatory Commission were not well managed.** Peach, J.D. (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 29 Mar 1983. 20p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Review of small purchase procurements related to the Federal Energy Regulatory Commission's (FERC's) participation in the Trans-Alaska Pipeline System (TAPS) rate case showed that unrecorded accounts receivables and payables had been outstanding since 1980 and that several deficiencies existed in FERC's small purchase procurement practices. During this review, the unrecorded accounts receivables were collected and procurement procedures were changed to correct some of the noted deficiencies. Further action needs to be taken, however, to: (1) collect the interest accrued on the accounts receivables that had been outstanding, provided FERC can properly document notice of debt to the involved parties; (2) appropriately justify unauthorized procurements made during the TAPS discovery process or take steps to recover the amount expended; and (3) settle the unpaid liability to the Business Archives and Record Storage Company (BARSCO).

39002 **(TENRAC/ADM—81-001) Texas Energy and Natural Resources Advisory Council annual report, 1981.** (Texas Energy and Natural Resources Advisory Council, Austin (USA)). Dec 1981. 174p. NTIS, PC A08/MF A01. Order Number DE83902087.

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This report documents the activities and accomplishments of the Texas Energy and Natural Resources Advisory Council during the year ending December 31, 1981. The primary function of the Council is energy and natural resources policy planning and development. Policy planning involves development of a consensus among key officials and leaders of the state so that, to the extent possible, Texas speaks with one voice on energy and natural resources. Policy development takes the form of major policy reports, resolutions, and legislative proposals. Crude oil and natural gas decontrol and allocation and energy technology development were addressed. Energy development projects concentrated on lignite and geologic studies for increased oil recovery. Funding was cut back for energy conservation programs. Major actions taken at council meetings and resolutions adopted by TENRAC are included. (DMC)

## 2950 Hydrogen And Synthetic Fuels

*REFER ALSO TO CITATION(S) 38548, 39078*

39003 **(AD-A—125153/7) Management impact assessment of refuse-derived fuel implementation at Wright-Patterson Air Force Base. Final report 30 Sep 80-11 Mar 81.** Huff, W.J.; McIntosh, R.K. (Ultrasystems, Inc., Fairfax, VA (USA)). 19 Mar 1982. 54p. NTIS, PC A04/MF A01.

This study has shown that the impact of specifying, procuring, using, and monitoring refuse-derived fuel (RDF) on the organizational structure and the operations and management activities of Wright-Patterson Air Force Base has been generally minimal and essentially absorbed into the various ongoing functional activities. However, the project manager devoted over 75 percent of his time to the program since it started and additional housecleaning personnel were assigned to the operating staff to remove the dust and debris resulting from the RDF. The research and development nature of this particular activity contributes to the necessity of having a project manager with time to keep the program on track and interested persons informed as to its progress. Weather this impact would be reflected in follow-on implementation programs is problematic and dependent upon how the program is viewed locally, the need for further RandD, and the visibility required or desired. The level of effort dedicated to this project was 5.6 man-years the first year and is expected to be 4.0 man-years the second year. The associated salary costs are $130,500 and $86,500, respectively. An assessment of the applicability of CITA to the operation of the RDF facility at WPAFB indicates that this and other Air Force central heating plants will be reviewed for possible contract operation in FY 1984.

## 2960 Electric Power

*REFER ALSO TO CITATION(S) 38873, 38874, 38881, 38887, 38895, 38983, 38987, 39009, 39066*

39004 **(ESC-WR—82-26) Calculations using the energy model SELPE for the labor demand scenario for the public debate on energy.** Boonekamp, P.G.M.; Koenders, N.J.; Oostvoorn, F. van. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). 1982. 53p. (In Dutch). Stichting Energieonderzoek Centrum Nederland, Petten.

Calculations with the energy model SELPE have been made on the effects of labor diversification on the electric power generation and the effects of electric power generation on the environment. The influence of employment and labor redistribution on the

use of energy sources in the Netherlands are the framework for the calculations. Costs aspects are calculated too.

39005 **(TENRAC/ADV—80-001) Report of the Advisory Committee on Industrial and Electric Utility Fuel Use Policy.** (Texas Energy and Natural Resources Advisory Council, Austin (USA). Advisory Committee on Industrial and Electric Utility Fuel Use Policy). 11 Jun 1980. 61p. NTIS, PC A04/MF A01. Order Number DE83902077.

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Research conducted by the Committee found that existing fuel use legislation will cause electric utilities in the Electric Reliability Council of Texas (ERCOT) to reduce drastically their use of gas, substituting coal and oil. It is recommended that: the Power Plant and Industrial Fuel Use Act be amended such that utility boilers that are not coal-capable without modification be allowed to burn natural gas or oil for the remainder of their useful lives or until a scarcity of natural gas can be demonstrated; automatic fuel adjustment clauses be permitted after December 31, 1985; the prohibition against funding for nuclear projects in Phase II contained in the House version of the backout bill be removed and that national policy regarding the development of nuclear power be re-examined to see if delays in construction and licensing can be shortened; synthetic fuels, especially gasified coal and alternative technologies, be developed in a timely manner; all plant conversions or shutdowns that occur as a result of federal mandate be wholly supported by federal funds; all fuel displacement activities be evaluated in terms of both regional economics benefit and cost analysis and regional environmental benefit and cost analysis; and if the Fuel Use Act is amended as proposed by the oil backout program, the implementation of the legislation be as efficient as possible.

39006 **(TVA/OEDC/MO—83/2) OEDC proud fifty: Tennessee Valley Authority.** (Tennessee Valley Authority, Chattanooga (USA)). 1983. 74p. NTIS, PC A04/MF A01. Order Number DE83902005.

This booklet illustrates 50 years of the TVA's Office of Engineering Design and Construction's contribution to the agency mission of unified resource development. The text is divided into decades: thirties, forties, etc. (DLC)

39007 **(TVA/PUB—83/34) Power program summary. Volume II.** (Tennessee Valley Authority, Chattanooga (USA)). 30 Jun 1982. 92p. NTIS, PC A05/MF A01. Order Number DE83902010.

This volume includes personal testimonies of TVA's past service and accomplishments, statistical review, financial statements, sales statistics, and rate schedule information. (DLC)

39008 **(TVA/PUB—83/35) Weather-sensitive electric-load simulation: a powerful tool in today's decision environment.** Dobrow, S.A. (Tennessee Valley Authority, Chattanooga (USA)). Feb 1983. 29p. NTIS, PC A03/MF A01. Order Number DE83902009.

This paper presents a quantitative model with ratemaking applications. The model provides for analyses of weather patterns and population trends as they impact customer rate class loads. Various scenarios may be used to generate class loads. These loads can then be utilized to perform cost-of-service studies and to test the revenue stability of alternative rate structures. Loads from different scenarios can be used in cost-of-service studies to perform sensitivity analysis on the assumptions made in the determination of revenue requirements for power rates. Also, sensitivity analysis of billing determinants using simulation studies can reduce the financial uncertainty of rate design and/or alert management to the magnitude of uncertainty for consideration when setting approriate margins in the rates.

## 2980 Consumption And Utilization

*REFER ALSO TO CITATION(S) 38871, 38877, 38878, 38882, 38885, 39036, 39044, 39071*

39009 **(DOE/EIA—0035-(83/06)) Monthly energy review. First quarter 1983 summary.** Fichman, B.T. (ed.). (USDOE Energy Information Administration, Washington, DC). Jun 1983. 115p. NTIS, PC A06/MF A01. Order Number DE83013944.

Current data are presented for production, consumption, stocks, imports, exports, and prices for the principle energy commodities in the United States. Also included are data on international production of crude oil, consumption of petroleum products, petroleum stocks, and production of electricity from nuclear facilities. Energy production during March 1983 totalled 5.3 quadrillion Btu, an 8.5% decrease from the level of production during March 1982. Coal production fell 19.4% and natural gas production was down 9.8%. Petroleum production increased 0.6%. Production of all other forms of energy combined increased 3.4%. Energy consumption in March 1983 totalled 6.2 quadrillion Btu, 2.5% below the level of consumption during March 1982. Decrease occurred in the consumption of natural gas (6.9%), coal (2.8%), and petroleum (0.5%). Consumption of all other forms of energy combined increased 3.5%. Net imports of energy during March 1983 totalled 0.5 quadrillion Btu, 4.5% below the level of imports during March 1982. Net imports of petroleum decreased 21.1%, and net imports of electricity and coal coke combined increased 5.2%. Natural gas net imports increased 1.2%. Net exports of coal decreased 40.7%.

39010 **(DOE/EIA—0214(81)S) State energy data report supplement, 1960-1981.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Jun 1983. 86p. NTIS, PC A05/MF A01. Order Number DE83013376.

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This report presents selected summaries and percent changes of energy consumption by State, by principal energy source, and by major end-use sector. In this report, the major end-use sectors are residential, commercial, industrial, transportation and electric utility sectors. From 1960 to 1981, the amount of energy consumed in the United States grew each year except for two periods. First, consumption decreased in 1974 and 1975 following the Arab oil embargo; second, consumption fell each year after 1979, when a record amount of energy was consumed. In 1981, U.S. energy consumption totaled 74.0 quadrillion British thermal units (Btu), down 2.6 percent from 1980 and down 6.2 percent from the 1979 record of 78.9 quadrillion Btu.

39011 **(DOE/EIA—0321-2) Residential energy consumption survey: consumption and expenditures, April 1980-March 1981. Part 2. Regional data.** Egan, B. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Jun 1983. 278p. NTIS, PC A13/MF A01. Order Number DE83013590.

This is the third report on the 1980 Residential Energy Consumption Survey, which covers the period April 1980 through March 1981. It contains data for the 4 census regions and the 9 census divisions. Total and average consumption and expenditures of total and specific fuels are classified by significant energy-related characteristics of the household. The fuels include natural gas, electricity, fuel oil, kerosene, and liquid petroleum gases. Wood data are presented only for the United States and the 4 census regions.

## 2990 Unconventional Sources And Power Generation

*REFER ALSO TO CITATION(S) 38583, 38591, 38598, 38602, 38603, 38608, 38610, 38611, 38612, 38614, 38615, 38627, 38720, 38872, 38981, 39065, 39078, 39387, 39388*

39012 **(GAO/ID—82-57) AID's renewable energy projects.** (General Accounting Office, Washington, DC (USA). International Div.). 13 Aug 1982. 10p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Efforts by the US to promote renewable energy and fuelwood projects in developing countries were reviewed. Issues of

slow project implementation and questionable field-testing of energy devices are discussed.

# 30 DIRECT ENERGY CONVERSION

## 3001 Mhd Generators

**39013 (DOE/ET/10815—91) Simulation of starting transients in the UTSI MHD generator.** Liao, Y.F. (Tennessee Univ., Knoxville (USA)). Mar 1983. Contract AC02-79ET10815. 128p. NTIS, PC A07/MF A01. Order Number DE83013208.

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A numerical procedure for solving the unsteady, two-dimensional, compressible Navier-Stokes equations has been extended for Magnetohydrodynamic (MHD) flows by the inclusion of the appropriate Lorentz force and Joule heating terms in the governing equations. With appropriate initial and boundary conditions, the procedure can be used for the investigation of transient phenomena as well as the asymptotic steady-state characteristics of internal MHD flows. Results obtained for the simulation of starting processes in The University of Tennessee Space Institute (UTSI) Coal-Fired MHD flow train are presented and found to be in good agreement with experimental observations.

**39014 (DOE/ET/11417—18) MHD Performance Demonstration Experiment, October 1, 1981-September 30, 1982.** Whitehead, G.L.; Christensen, L.S.; Felderman, E.J.; Lowry, R.L.; Bordenet, E.J.; Allee, E.G. (Arnold Engineering Development Center, Arnold Air Force Station, TN (USA)). Jan 1983. Contract AI01-78ET11417. 75p. NTIS, PC A04/MF A01. Order Number DE83012863.

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The Arnold Engineering Development Center (AEDC) has been under contract with the Department of Energy (DOE) since December 1973 to conduct a magnetohydrodynamic (MHD) High Performance Demonstration Experiment (HPDE). The objective of this experimental research is to demonstrate the attainment of MHD performance on sufficiently large scale to verify that projected commercial MHD objectives are possible. This report describes the testing of the system under power-producing conditions during the period from October 1, 1981, to September 30, 1982. During this period, approximately 28 MW of electrical power was produced during a short duration test. A magnet failure and subsequent damage in a fairly inaccessible location required a significant amount of time to repair, seriously limiting the number of power production tests. The repair and some improvements were accomplished and the magnet successfully tested to the 4.0 Tesla (T) level. Combustor operation was refined and improved and the entire flow train is once again ready for high magnetic field tests.

**39015 (FE—2248-21) U-02 Phase III proof test series. Final report.** (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). Jan 1979. Contract AC01-76ET10789. 253p. NTIS MF A01. Order Number DE83013504.

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In preparation for the joint US-USSR Test of US MHD Electrode System in the U-02 Facility - Phase III, a series of three proof tests were conducted in the Westinghouse Electrode Systems Test Facility (WESTF). The objective of the proof test series was to provide a basis for the selection of electrode and insulator materials and designs to be included in the Phase III Module to be operated under clean firing conditions in the U-02 Facility. Results of the design activities, test operations, pre- and post-test material characterization effort, and post-test thermal and electrical performance evaluations are presented. As a result of proof test series, $LaCrO_3$ based electrode materials, MgO and $MgAl_2O_4$ interelectrode materials and nickel mesh attachments were selected for inclusion in the U-02 Phase III Module to be tested in the USSR in May 1978.

**39016 (SAND—83-0219C) Experimental investigation of an explosive-driven pulse power system.** Tucker, T.J.; Hanson, D.L.; Cnare, E.C. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 9p. (CONF-830621—9). NTIS MF A01. Order Number DE83012873.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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The results obtained in the test of a pulse-power system composed of an explosively driven compressed magnetic-field current generator driving an explosive opening switch and a 20 nH inductive load are presented. It is shown that microsecond risetime, multimegampere current pulses can be produced by this technique.

## 3005 Fuel Cells

**39017 (DOE/ET/11304—25) Development of molten-carbonate fuel-cell technology. Technical progress report, July-September 1982.** Pigeaud, A. (Energy Research Corp., Danbury, CT (USA) ). 1982. Contract AC02-76ET11304. 24p. NTIS, PC A02/MF A01. Order Number DE83013564.

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Effort during this reporting period focused primarily on developing a strong, creep-resistant anode. This is an important issue, because any change in anode thickness may result in contact loss and stack performance decay. The ceramic impregnation of ERC's standard anodes does provide improved strength but further improvements appear necessary based on our creep and cell tests. A preassembly compression procedure to minimize large pores has proven useful in this regard and increased ceramic loading is also being examined. Other aspects investigated this quarter include fabrication of tape-cast electrolyte support structures for studying the implications of thin matrices on cell performance.

**39018 (DOE/ET/11304—26) Development of molten-carbonate fuel-cell technology. Technical progress report for the quarter, October-December 1982.** (Energy Research Corp., Danbury, CT (USA) ). 1982. Contract AC02-76ET11304. 24p. NTIS, PC A02/MF A01. Order Number DE83013568.

The development of anodes with improved creep strength and cell testing of thin matrix structures were the main focus of the program during this reporting period. Results of creep testing, and laboratory- and bench-scale testing, along with post-test analyses are presented.

**39019 (DOE/MC/19077—T1) Development of a hot-gas-cleanup system for integrated coal-gasification/molten-carbonate fuel-cell power plants. Quarterly progress report, January-March 1983.** Lyke, S.E.; Sealock, L.J. Jr.; Brown, M.D.; Roberts, G.L. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC21-82MC19077. 64p. NTIS, PC A04/MF A01. Order Number DE83013442.

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The overall objective of this project is to conduct research and development to demonstrate the Solid-Supported Molten Salt (SSMS) Process for removing HCl and sulfur compounds from hot, pressurized fuel gas. Results of the project are expected to demonstrate the technical and economic feasibility of using the SSMS Process in an integrated coal gasification molten carbonate fuel cell power plant and will provide a firm basis to proceed with scale-up and further development of the process. Successful completion of the project will: (1) demonstrate at the bench scale that the SSMS Process can remove $H_2S$, COS, and HCl to less than 1 ppM; (2) provide performance data in sufficient detail to allow scale-up and economic evaluation of the process; (3) design a scaled-up test absorber suitable for use with a pressurized fluidized-bed gasifier with 150 lb/h of coal throughput; and (4) complete a conceptual design and capital and operating cost estimate for a commercial-scale absorber system. This project will develop a process for removal of HCl and sulfur compounds from hot fuel gas using molten salts supported on a solid substrate. The experimental work will consist of equilibrium studies, laboratory-scale sorbent reaction studies, and bench-scale packed-bed absorber tests. Progress is reported. (WHK)

**39020 (DOE/MC/19077—T2) Development of a hot-gas-cleanup system for integrated coal-gasification/molten-carbonate fuel-cell power plants. Quarterly progress report, October-December 1982.** Sealock, L.J. Jr.; Lyke, S.E.; Hallen, R.T.; Roberts, G.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1983. Contract AC21-82MC19077. 35p. NTIS, PC A03/MF A01. Order Number DE83013511.

The overall objective of this project is to conduct research and development to demonstrate the Solid-Supported Molten Salt (SSMS) Process for removing HCl and sulfur compounds from hot, pressurized fuel gas. Results of the project are expected to demonstrate the technical and economic feasibility of using the SSMS Process in an integrated coal gasification molten carbonate fuel cell power plant and will provide a firm basis to proceed with scale-up and further development of the process. Successful completion of the project will: (1) demonstrate at the bench scale that the SSMS Process can remove $H_2S$, COS, and HCl to less than 1 ppM; (2) provide performance data in sufficient detail to allow scale-up and economic evaluation of the process; (3) design a scaled-up test absorber suitable for use with a pressurized fluidized-bed gasifier with 150 lb/h of coal throughput; and (4) complete a conceptual design and capital and operating cost estimate for a commercial-scale absorber system. This project will develop a process for removal of HCl and sulfur compounds from hot fuel gas using molten salts supported on a solid substrate. The experimental work will consist of equilibrium studies, laboratory-scale sorbent reaction studies, and bench-scale packed-bed absorber tests. These investigations will be followed by an engineering and economic assessment of the process. Work in the first year of the project will consist of equilibrium studies and laboratory-scale sorbent reaction studies. Progress is described. (WHK)

**39021 (DOE/NASA/0241—6) Develop and test fuel-cell-powered on-site integrated total-energy systems. Phase III. Full-scale power plant development. 6th quarterly report, May-July 1982.** Kaufman, A.; Johnson, G.K. (Engelhard Corp., Edison, NJ (USA). Engelhard Industries Div.). 20 Apr 1983. Contract AI01-80ET17088. 30p. (NASA-CR—168021). NTIS, PC A03/MF A01. Order Number DE83012979.

Satisfactory performance is reported for the three 12-cell sub-stacks of the 5 kW stack rebuild. Early general conclusions are presented from an economic study of OS/IES by subcontractor Arthur D. Little, Inc. Results are reported on a successful 700-hour test of a 3-cell stack in the full-sized configuration (0.33 m x 0.56 m). Construction of a 5-kW-equivalent methanol/steam reformer based on a commercial shell-and-tube heat exchanger was completed. Several test runs are summarized. Preliminary conclusions are presented on the technical and economic aspects of fuel cell/HVAC interaction for OS/IES as developed by the subcontractor, Trane Company. Physical data are presented on several dense graphite materials which are candidates for gas-distribution plates. Performance of a new cathode catalyst is reported.

**39022 Use of low temperature blowers for recirculation of hot gases.** Maru, H.C.; Forooque, M. US Patent Application 6-409,696. 19 Aug 1982. 19p. Contract AI01-80ET17088.

An apparatus is described for maintaining motors at low operating temperatures during recirculation of hot gases in fuel cell operations and chemical processes such as fluidized bed coal gasification. The apparatus includes a means for separating the hot process gas from the motor using a secondary lower temperature gas, thereby minimizing the temperature increase of the motor and associated accessories.

**39023 Desulfurization sorbent regeneration.** Jalan, V.M.; Frost, D.G. US Patent Application 6-395,894. 7 Jul 1982. 13p. Contract W-31-109-ENG-38.

A spent solid sorbent resulting from the removal of hydrogen sulfide from a fuel gas flow is regenerated with a steam-air mixture. The mixture of steam and air may also include additional nitrogen or carbon dioxide. The gas mixture contacts the spent sorbent containing metal sulfide at a temperature above 500°C to regenerate the sulfide to metal oxide or carbonate. Various metal species including the period four transition metals and the lanthanides are suitable sorbents that may be regenerated by this method. In addition, the introduction of carbon dioxide gas permits carbonates such as those of strontium, barium and calcium to be regenerated. The steam permits regeneration of spent sorbent without formation of metal sulfate. Moreover, the regeneration will proceed with low oxygen concentrations and will occur without the increase in temperature to minimize the risk of sintering and densification of the sorbent. This method may be used for high-temperature fuel cells.

**39024 High-temperature sorbent method for removal of sulfur-containing gases from gaseous mixtures.** Young, J.E.; Jalan, V.M. US Patent Application 6-395,895. 7 Jul 1982. 15p. Contract W-31-109-ENG-38.

A copper oxide-zinc oxide mixture is used as a sorbent for removing hydrogen sulfide and other sulfur containing gases at high temperatures from a gaseous fuel mixture. This high-temperature sorbent is especially useful for preparing fuel gases for high temperature fuel cells. The copper oxide is initially reduced in a preconditioning step to elemental copper and is present in a highly dispersed state throughout the zinc oxide which serves as a support as well as adding to the sulfur sorbtion capacity. The spent sorbent is regenerated by high-temperature treatment with an air fuel, air steam mixture followed by hydrogen reduction to remove and recover the sulfur.

**39025 Fuel cell design and assembly.** Meyerhoff, A. US Patent Application 6-394,071. 1 Jul 1982. 20p.

The present invention is directed to a novel bipolar cooling plate, fuel cell design and method of assembly of fuel cells. The bipolar cooling plate used in the fuel cell design and method of assembly has discrete opposite edge and means carried by the plate defining a plurality of channels extending along the surface of the plate toward the opposite edges. At least one edge of the channels terminates short of the edge of the plate defining a recess for receiving a fastener.

# 32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

**39026 (DOE/CS/10044—T1) Institutional responses to energy alternatives in St. Louis, Missouri.** Bechhoefer, A.S.; Maurer, C.D. (Urban Inst., Washington, DC (USA)). Dec 1980. Contract AC01-79CS10044. 53p. NTIS, PC A04/MF A01. Order Number DE83013239.

Major factors affecting the implementation of energy alternatives are discussed including: energy and overall growth, energy conservation and the impact of electric rate structures, transportation alternatives, energy conservation and the role of neighborhood organizations, and renewable and solar options. Two important issues have to do with political fragmentation and reduced energy consumption. (MHR)

**39027 (DOE/CS/10044—T3) Institutional responses to energy alternatives in Austin, Texas. Working Paper 1382-2.** Bechhoefer, A.S.; Maurer, C.D. (Urban Inst., Washington, DC (USA)). Nov 1980. Contract AC01-79CS10044. 66p. NTIS, PC A04/MF A01. Order Number DE83012456.

The institutional influences on energy-related decisions and the five major energy issues to which those decisions apply are examined. The five issues are: energy and overall growth, energy conseervation and the impact of utility rate structures, energy and downtown revitalization, the role of neighborhood based associations in energy conservation and solar energy options. (MHR)

## 3201 Buildings

*REFER ALSO TO CITATION(S) 38773, 38774, 38776, 38778, 38780, 38782,*

*38790, 38791, 38797*

39028 (CONF-820940—, pp 50) **Passive cooling by natural ventilation.** Chandra, S.; Fairey, P.W. III. (Florida Solar Energy Center, Cape Canaveral). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

39029 (CONF-820940—, pp 51-72) **Earth contact systems: detailed model development, response factor subroutines and preliminary design guidelines.** Meixel, G.D. Jr. (Univ. of Minnesota, Minneapolis); Shen, L.S.; Carmody, J.C.; Cumali, Z.O.; Davis, P.K.; Bull, J.C. Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

A detailed numerical model predicting earth contact heat transfer due to conduction has been completed and is currently being validated. This model incorporates appropriate definition of surface boundary conditions and building details. Creation of the earth contact subroutines have utilized discretization processes and boundary conditions similar to the detailed model to generate response factors. Extension of the detailed model to include moisture transport and the associated validation experiments are discussed. The process for preparing preliminary design guidelines for basic earth contact components - walls, floors and roofs - are presented.

39030 (CONF-820940—, pp 73-87) **Earth contact systems: soil temperature and thermal conductivity data, heat flux data and meter calibration.** Bligh, T.P.; Knoth, B.H.; Smith, E.A.; Apthorp, D.M. (Massachusetts Inst. of Tech., Cambridge). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Thermal data from laboratory experiments and in-site measurements from an earth sheltered house; soil temperature, wall heat flux and apparent soil thermal conductivity data are presented and discussed. The data shows some of the characteristics of the thermal behavior of the house and soil. Thermal conductivity probe design is included. Soil temperatures are presented in the form of isotherms for various times of the year, examples of heat flux data for one day, and soil thermal conductivity data for several days duration are plotted. Discussions of soil temperature measurements, heat flux meter calibrations are presented.

39031 (CONF-820940—, pp 119-129) **Daylight strategies.** Place, W.; Fontoynont, M.; Conner, C.; Kammerud, R.; Andersson, B.; Bauman, F.; Carroll, W.; Howard, T.C.; Mertol, A.; Webster, T. (Lawrence Berkeley Lab., CA). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

An investigation has been made of potential lighting electricity reductions and associated thermal impacts of replacing electric light with sunlight admitted through rooftop glazing on a single-story, prototypical office building. Experimental scale models have been used to determine the fraction of the solar radiation entering the aperture which reaches the work plane as useful illumination. This information is used in a developmental version of the building energy analysis computer program BLAST-3.0 to predict reductions in lighting electricity and the impacts on energy consumption for heating and cooling the building. It is found in general that the lighting electricity reductions are more significant than the heating and cooling impacts in a properly designed system. In an improperly designed daylighting system, where reduction of lighting electricity is the only design criterion, deleterious thermal impacts can negate the lighting electricity benefits. The design implications of the results are discussed and future directions for the work are outlined.

39032 (CONF-820940—, pp 154-156) **Design guidelines for commercial buildings: design process design tools by building type.** Floyd, R.N. (Tennessee Valley Authority, Chattanooga). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The Tennessee Valley Authority and its architectural, engineering, and other professional consultants are now developing Design Guidelines for commercial and industrial buildings. Design Guidelines for twenty building types are scheduled for development over the next few years with five Design Guidelines being produced at this time. This paper describes the structure and content of the Design Guidelines and addresses a few key issues surrounding the development and use of these essentially resource oriented design process design tools.

39033 (CONF-820940—, pp 270-271) **Optics and materials research applied to controlled radiant energy transfer through building envelopes.** Goldner, R.B. (Tufts Univ., Medford, MA). Nov 1982. NTIS, PC A16/MF A01. Contract AC02-82CE30753.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

39034 (CONF-820940—, pp 272-278) **In-situ measurement of soil thermal conductivity and soil moisture movement.** Bloom, J.A.; Waller, M.J. (EarthTech Research Corp., Baltimore, MD). Nov 1982. NTIS, PC A16/MF A01. Contract AC03-80SF11509.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

Instrumentation procedures and analysis techniques have been developed for the measurement of soil thermal conductivity and soil moisture migration adjacent to earth-sheltered structures and buried heat exchangers. The equipment will be used for developing data for use by designers of earth contact concepts. The instrumentation can be utilized with a minimal disturbance to the existing site. The instruments have been laboratory tested prior to field installation in order to assess performance and develop operational techniques.

39035 (CONF-820940—, pp 296-300) **Phase change thermal storage: a building industry perspective.** Kando, P.F. (NAHB Research Foundation, Inc., Rockville, MD). Nov 1982. NTIS, PC A16/MF A01.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The state of the art in phase change thermal storage is reviewed briefly. A multi-client research approach is described in which government and industry cooperate. The types of activities conducted under the multi-client approach are discussed. (MHR)

39036 **(CONF-830568—2) Energy interactions between building equipment systems.** Levins, W.P. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01. Order Number DE83012568.

From International technical appliance conference; West Lafayette, IN, USA (17 May 1983).

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The way in which an appliance is used or where the appliance is located affects its energy usage. The building-equipment system which usually is most affected by the efficiency and/or the manner of operation of other building-equipment systems (appliances) is the house heating and cooling (HVAC) system. Two cases of energy interactions between appliances and the house HVAC are discussed and measured operating data are used to calculate the appliance energy usage including the HVAC interaction. The first study involves the interaction between a heat-pump water heater (HPWH) and the house HVAC. Since a HPWH extracts energy from the air in its surroundings and adds it to the water it is heating, the load on the house HVAC will be changed if the HPWH is located in a conditioned space. The second study concerns the increased amount of infiltration air brought into a house caused by venting a clothes dryer to the outside. All the increased infiltration air must be conditioned by the house HVAC if the dryer is located in a conditioned space. Graphs and tables based on measured data are presented which show the estimated interaction of the house HVAC with a HPWH and vented electric clothes dryer.

**39037 (CONF-830615—4) Short-tube subcritical flow.** Mei, V.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE83003952.

From ASME summer meeting; Houston, TX, USA (20 Jun 1983).

The orifice model is generally accepted for the calculation of short-tube subcritical flow. For short tubes used as refrigerant expansion devices, the orifice model is found inadequate due to the wide variation of the upstream and downstream conditions. In a previous paper, a correlation was formed experimentally to show the effect of pressure differential and level of liquid subcooling on the orifice constant C. However, the effect of length over diameter ratio (L/D) was not included. In this follow-up study, a separate correlation is formed so that the influence of L/D is addressed.

**39038 (DOE/CE/15100—T1) Closed cycle clothes dryer. Final technical report.** Lewis, D.C. (Nyle Corp., Bangor, ME (USA)). 13 Jun 1983. Contract FG01-82CE15100. 44p. NTIS, PC A03/MF A01. Order Number DE83013474.

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It was decided that a comparison should be made between rotary and reciprocating compressors. The comparison would involve two sizes, one that was as large as would normally be permitted on a 120 volt circuit, and one that was half that size. It was also decided that the project would use standard, commercially available clothes dryers and room air conditioners for basic components. Five brands of clothes dryers were examined. After comparing the five commercially available units, the Hotpoint Model DLB1550 BALWH was selected for modification. The next step was the selection of the refrigeration system components. Because it would be faster to obtain the various components, it was decided to select a room air conditioner that could be adapted.

**39039 (DOE/CS/20420—T1) Engineering computer models for refrigerators, freezers, furnaces, water heaters, room and central air conditioners.** (Little (Arthur D.), Inc., Cambridge, MA (USA)). Nov 1982. Contract AC01-78CS20420. 294p. NTIS, PC A13/MF A01. Order Number DE83011923.

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This User's Guide provides the necessary information for understanding and using a computer model developed for the US Department of Energy which predicts the performance (energy consumption) of household refrigerators, refrigerator-freezers, and freezers. The model is capable of simulating various cabinet configurations (top-mount, bottom-mount, side-by-side, single-door) and refrigeration unit combinations (back-mounted static condenser with single forced convection evaporator, hot wall condenser with cooled wall panels, etc.). The program is comprised of two main subroutines: a cabinet heat-load submodel and a refrigeration unit submodel; they can be used separately for preliminary design analysis or together for performance evaluations. A technical description of the model and information on how to structure input parameters are provided. The user is provided with specific guidance for running the model on a computer. Specific instructions are given in the Appendices for changing and running the model using the operating language compatible with the DOE computer terminal system. Other users will have to modify the procedures in these sections as necessary for different computers.

**39040 (DOE/CS/20420—T2) Proposed framework for furnace and boiler test-procedure modifications.** (Little (Arthur D.), Inc., Cambridge, MA (USA)). Nov 1982. Contract AC01-78CS20420. 131p. NTIS, PC A07/MF A01. Order Number DE83012272.

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Present furnace test procedures were examined and a framework was proposed to modify the test procedures in order to better manage the evaluation of flue dampers, integrated furnace-water heaters; and low mass boilers. Assessment and recommendations for the treatment of these features.

**39041 (DOE/CS/25173—T1) Consumer-product survey.** (Market Facts, Inc., Chicago, IL (USA)). Mar 1982. Contract AC01-78CS25173. 159p. NTIS, PC A08/MF A01. Order Number DE83012388.

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A national survey of major appliance owners is reported. The study reports on the household appliance inventory, including purchase and usage information, as well as attitudes toward appliance energy efficiency. The data discussed is based on interviews with 4533 appliance owners. The information was collected in a one hour personal in-home interview. The sample used is Market Facts' National Probability Sample.

**39042 (DOE/PE/70047—T3) Housing, transportation, and energy systems technologies that relate to housing markets.** MacFadyen, D.J. (Technology and Economics, Inc., Cambridge, MA (USA)). 31 Dec 1980. Contract AC01-79PE70047. 76p. NTIS, PC A04/MF A01. Order Number DE83013875.

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Information is presented regarding impacts of transportation, building, and energy system technologies. Representative technologies are discussed to provide a framework for the consideration of possible impacts and policies. The following are discussed: single-family residential buildings, retrofit, multi-family and non-residential buildings; the impact of transportation developments on the housing industry; and the household and energy systems: 1980-2000. (MHR)

**39043 (ESC-WR—83-04) Public information on energy conservation and residential building insulation at the request of the Dutch Ministry of Economic Affairs.** Midden, C.J.H.; Ritsema, B.S.M. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Jan 1983. 61p. (In Dutch). Stichting Energieonderzoek Centrum Nederland, Petten.

Reported is a feasability study on a consumer information project with respect to energy conservation and the application of thermal insulation. Different aspects of information transfer including behavior modification are presented.

**39044 (FE—4528-T1(Vol.2)) Preparation and development of land use energy consumption data sets. Phase I final report. Volume II.** (Urban Systems Research and Engineering, Inc., Cambridge, MA (USA)). Aug 1978. Contract AC02-77CS20069. 304p. NTIS, PC A14/MF A01. Order Number DE83013414.

This volume summarizes and references existing data brought together from secondary sources regarding energy use in five land-use related areas: direct energy use in buildings, embodied energy in end-user structures, embodied energy in site preparation for structures, embodied energy in utility guideways, embodied energy in transportation guideways and intermediate structures, propulsion energy in transportation, and embodied energy in vehicles. It also provides a description of the process used for identifying, evaluating, and selecting metropolitan areas as potential case study sites for data collection in Phase II of this project.

**39045 (LBL—8688-Rev.3) DOE-2: BDL summary, Version 2.1B.** (Lawrence Berkeley Lab., CA (USA)). Jan 1983. Contract AC03-76SF00098. 97p. NTIS, PC A05/MF A01. Order Number DE83012486.

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This document contains in concise form the basic information on all commands and keywords in the Building Description Language (BDL) as well as a few supplementary tables and charts. It is to be used in conjunction with other DOE-2 documentation.

**39046 (LBL—9416) Calculating infiltration: implications for a construction quality standard.** Grimsrud, D.T.; Sherman, M.H.; Sonderegger, R.C. (Lawrence Berkeley Lab., CA (USA)). Apr 1983. Contract AC03-76SF00098. 34p. (CONF-821217—6). NTIS, PC A03/MF A01. Order Number DE83013445.

From ASHRAE/DOE conference on thermal performance of building envelopes; Las Vegas, NV, USA (5 Dec 1982).

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Extensive work in infiltration measurement and modeling has led to a simple method to calculate the leakage area of a house regardless of design or weather conditions. The leakage area, in

turn, is used in the LBL infiltration model to calculate infiltration for any weather condition. This method, which uses fan pressurization to measure the leakage area, has been used in a survey of over 300 houses located throughout North America. The results of that survey are presented and it is suggested that the present capability in infiltration modeling offers an excellent framework for an air leakage standard for residential building. Examples of the interpretation of such a standard are described based on the ventilation rates adopted in ASHRAE Standard 62-1981. The results of the interpretations illustrate differences in structural requirements that will occur when such a standard is applied to several ventilation system designs.

39047 **(LBL—14838-Rev.) Summary report of building energy compilation and analysis (BECA). Part V. Validation of energy-analysis computer programs.** Wagner, B.S.; Rosenfeld, A.H. (Lawrence Berkeley Lab., CA (USA)). Jan 1983. Contract AC03-76SF00098. 13p. (CONF-820849—12-Rev.). NTIS, PC A02/MF A01. Order Number DE83013443.

From Summer study in energy efficient buildings; Santa Cruz, CA, USA (22 Aug 1982).

BECA-V compiles and reviews comparisons of building energy-analysis techniques to measured building energy use. Preliminary results are summarized for the 12 studies reviewed to date. For commercial buildings, detailed computer programs were accurate to within about 10% when correct input data were available. For residential buildings, accuracy of building energy analysis programs was generally better than 1% when the buildings analyzed were intensively instrumented and monitored to eliminate errors in input. Two simplified programs suitable as building energy efficiency rating tools were, on average, accurate to within 15% for submetered and for less intensively monitored occupied houses.

39048 **(LBL—15972) Technological and economic issues in building energy use.** Curtis, R.B.; Weingart, J.M. (Lawrence Berkeley Lab., CA (USA)). Apr 1983. Contract AC03-76SF00098. 23p. (CONF-830365—1). NTIS, PC A02/MF A01. Order Number DE83012910.

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

The following are discussed relative to energy efficiency and buildings in West Africa: traditions and current concerns in energy efficiency buildings, establishing national enery efficient building policies, obstacles to implementing eneryg efficiency for buildings, development of a West African building energy design manual, and computer simulation of building energy use. The DOE-2 building energy use analysis program is discussed as follows: motivation for development, general description, uses, examples of application, and possibilities for Africa. (MHR)

39049 **(ORNL/CON—101/Vol.1) Thermal efficiency standards and codes. Volume 1. State-of-the-art literature review and analysis of secondary data.** Collins, N.E.; McCold, L.N.; Zuschneid, P. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 232p. NTIS, PC A11/MF A01. Order Number DE83013716.

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The impacts of mandated thermal efficiency standards on construction practices were estimated by: (1) reviewing the standard methology, correcting data errors, and adding factors such as compliance; (2) analyzing state legislation to determine date of code/standard adoption, date of implementation, buildings covered, and stringency of the code administration process and training programs on enforcement and construction practices; and (3) examining the correlations between measures of code compliance, the code characteristics described above, and such external variables as climate, fuel prices, and state demographics. Among the conclusions drawn from this research are that: (1) reported energy savings were overestimated by as much as 500% in 1980 due solely to inaccurate construction rates and energy consumption figures; (2) as of January 1, 1982, only 27 states had codes which fully met federal requirements and seven states had no effective codes in place which even partially met requirements; and (3) no significant correlations were found between existence, age, or characteristics of a code/standard and improved construction practices or compliance with ASHRAE insulation requirements. Conclusions cover policy implications related to federal attempts to mandate state and local legislation, the role of the construction industry in improving energy efficiency in new buildings, and suggestions for further research.

39050 **(ORNL/CON—124) Evaluation of the BPA Residential Weatherization Pilot Program.** Hirst, E.; Bronfman, B.; Goeltz, R.; Trimble, J.; Lerman, D. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 132p. NTIS, PC A07/MF A01. Order Number DE83013734.

A detailed quantitative evaluation of the BPA Residential Weatherization Pilot Program is described. The program, which operated from 1980 through 1982, provided free home energy audits to more than 6000 electrically-heated homes in the service areas of 11 small public utilities in the Pacific Northwest. In addition, the program provided zero-interest loans for weatherization of almost 4000 of these audited homes. The total cost of the pilot program was almost $8 million ($2600 per audited and weatherized home).

39051 **(ORNL/Sub—79-7685/2) New aggregation methodology applied to residential air-conditioner loads.** Nguyen, H.T.T. (Tennessee Univ., Knoxville (USA). Dept. of Electrical Engineering). Feb 1983. Contract W-7405-ENG-26. 97p. NTIS, PC A05/MF A01. Order Number DE83013732.

Thesis.

The development and evaluation of a low-order probabilistic model of large signal behavior of aggregate air conditioner loads is presented. The model demonstrates that severe load oscillations can occur for large signal disturbances (outages). The sensitivity of the large signal behavior to the driving stochastic processes (e.g., outdoor temperature) is demonstrated. The sensitivities of the large signal behavior to the heat transfer coefficient of the house, variation of voltage and frequency and size of air conditioner are studied. The model also demonstrates that the large signal behavior can be very sensitive to the thermostat settings. The model is based on a Markov chain approximation to the indoor-temperature distribution; this approximation allows easy computation of the model parameters.

39052 **(TVA/OP/ECR—83/10) Water heating/space-conditioning control test. Final report, 1979-1981.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Conservation and Rates). Sum 1982. 138p. NTIS, PC A07/MF A01. Order Number DE83902001.

A 457-family test project was conducted to assess the potential TVA/distributor system benefits from specific residential electrical load management techniques, from July 2, 1979, March 31, 1981. Results indicates that management of standard and storage water heaters can achieve a 1.36-kW peak demand reduction per unit during winter months and a 0.39-kW peak demand reduction per unit during summer months. Management of residential central air-conditioning can produce a 1.0-kW peak demand reduction per unit on very hot summer days when the maximum daily temperature reaches at least 100°F. A 0.65-kW peak demand reduction per air-conditioning unit could be achieved on a day with a maximum temperature of 96°F. These air-conditioning demand reductions result from a 25% (7.5 minutes off during a 30-minute period) management strategy. Space heating test data, which was based on the 25% cycling strategy, showed negligible peak demand reductions.

39053 **US energy conservation research in transportation and buildings.** Savitz, M. (Dept. of Energy, Washington, DC). pp 294-300 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). (CONF-821121—).

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

The aims of the United States Energy Conservation Research Program are to conduct basic research in fields of scientific inquiry where new knowledge can expand the generic technology base underlying energy conservation. This will allow the private sector to develop ways to make more efficient use of available energy and to facilitate use of nonpetroleum energy sources. In this context, conservation connotes using energy more wisely while

maintaining the Nation's standard of living, rather than sacrificing and doing without. With implementation of petroleum price decontrol, market price increases and expectations of increases in energy costs will accelerate the market-place applications of economical energy-saving technologies, as well as the development and demonstration of previously unproven technologies. The President's economic recovery program, which includes lower taxes, tax credits for research and development, and removal of unnecessary regulatory burdens, will help improve the efficient operation of the market for energy. Thus, recognizing that each sector of our Nation's economy has very strong financial incentives, incentives to develop and demonstrate technologies that appear technically and economically promising, the Federal Conservation Program will focus on expanding our scientific knowledge base by supporting generic technology base projects and more fundamental research activities.

## 3202 Transportation

*REFER ALSO TO CITATION(S) 39044, 39053, 39071*

## 3203 Industry And Agriculture

*REFER ALSO TO CITATION(S) 38458, 38459, 38617, 38622, 38990, 38991, 39037, 39342*

39054 **(AD-A—124047/2) Energy monitoring and control systems - factory test procedures. Final report.** Cosiol, J.; Bomar, F. (Kling-Lindquist, Inc., Philadelphia, PA (USA)). Dec 1982. 184p. NTIS, PC A09/MF A01.

This report presents generic factory test procedures for EMCS. These test procedures are designed to demonstrate in the factory the technical, operational, and performance of an EMCS procured using the tri-service EMCS guide specifications.

39055 **(DOE/CE/15084—T1) Pritchard's pilot-plant test of Duval's Millscale Deoiling Process. Final report.** (Pritchard Corp., Kansas City, MO (USA)). Apr 1983. Contract FG01-82CE15084. 262p. NTIS MF A01. Order Number DE83012415.

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The Pritchard Corporation has completed its test of the Duval Millscale Deoiling Process at the Duval Millscale Deoiling Pilot Plant located in Aurora, Ohio. This final report includes: all the experimental data taken during the test; an evaluation of the experimental data; a design of a commercial 1000 ton/d millscale deoiling plant; an order of magnitude, +-25%, cost estimate for a 1000 ton/d commercial unit; and a recommendation for the next necessary step in development of a commercial unit.

39056 **(DOE/ID/12170—T1) High-temperature burner-duct-recuperator (HTBDR) program. Annual report, October 1981-September 1982.** Coombs, M.; Kotchick, D.; Strumpf, H. (AiResearch Mfg. Co., Torrance, CA (USA)). May 1983. Contract FC07-81ID12170. 251p. NTIS, PC A12/MF A01. Order Number DE83013678.

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The objectives of the HTBDR program are to develop, construct, operate, and evaluate a 2000°F combustion air heat recovery system in a typical industrial furnace application. The HTBDR comprises a high-temperature ceramic recuperator; a dual fuel burner capable of operating with up to 2000°F preheated air; and the associated ducting, controls, and auxiliary equipment. The inudstrial host site for the 1-year evaluation effort is an aluminum remelt furnace located at Tandem Industries, Long Beach, California. Task 1 was completed with the preliminary design of the HTBDR system for the industrial host site furnace. The recuperator and burner development efforts were initiated. The approach to this development effort was to undertake the design, fabrication, and operation of a 5-MMBtu/hr prototype recuperator and its companion burner in a facility where both the recuperator and burner can be tested over the range of operating conditions of interest. The system development aspects of the program, which during this current phase are concerned with the design of the prototype recuperator/burner test facility, interconnecting ducting, control and auxiliary support systems, etc., are summarized. Descriptions of various laboratory experiments performed in support of the recuperator/burner development efforts are presented. These experiments were conducted to obtain basic design data and/or to develop specific subcomponent elements for the prototype recuperator and/or burner.

39057 **(ESC-WR—83-01) Energy and fabrication aspects of the Dutch base metal industry.** van Wees, F.G.H. (Stichting Energieonderzoek Centrum Nederland, Petten. Energie Studie Centrum). Jan 1983. 90p. (In Dutch). Stichting Energieonderzoek Centrum Nederland, Petten.

The energy use of the base metal industry is described. A description of the energy consumption and economic aspects related to the different production processes and a description of the installations are given.

39058 **(FE—2549-T2) Development of potential uses for the residue from fluidized bed combustion processes. Quarterly technical progress report, March-May 1979.** Minnick, L.J. (Minnick (L. John), Plymouth Meeting, PA (USA)). 1979. Contract AC21-77ET10415. 26p. NTIS, PC A03/MF A01. Order Number DE83013506.

A research program to evaluate the solid wastes from fluidized bed combustion for potential commercial uses is described. Methods by which the material can be safely disposed of should commercial applications be slow in developing or not of sufficient magnitude to use all the waste materials are to be explored, also.

39059 **(N—8314343) Potential availability of diesel waste heat at Echo Deep Space Station (DSS 12).** Hughes, R.D. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1982. 17p. NTIS, PC A09/MF A01.

In Telecommun. and Data Acquisition Progr. J.; p 166-182 (SEE N83-14323).

Energy consumption at the Goldstone Echo Deep Space Station (DSS 12) is predicted and quantified for a future station configuration which will involve implementation of proposed energy conservation modifications. Cogeneration by the utilization of diesel waste-heat to satisfy site heating and cooling requirements of the station is discussed. Scenarios involving expanded use of on-site diesel generators are presented.

39060 **(PNL—4529) Technical descriptions of ten irrigation technologies for conserving energy.** Harrer, B.J.; Wilfert, G.L. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 154p. NTIS, PC A08/MF A01. Order Number DE83013283.

Technical description of ten technologies which were researched to save energy in irrigated agriculture are presented. These technologies are: well design and development ground water supply system optimization, column and pump redesign, variable-speed pumping, pipe network optimization, reduced-pressure center-pivot systems, low-energy precision application, automated gated-pipe system, computerized irrigation scheduling, and instrumented irrigation scheduling. (MHR)

39061 **Production of industrial steam using syngas to methane conversion.** Davis, C.R. (General Electric Company, 310 DeGuigne Drive, P.O. Box 5020, Sunnyvale, CA 94036). *Transactions of the American Nuclear Society;* **43**: 34-35(1982). (CONF-821103—).

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

## 3206 Municipalities And Community Systems

*REFER ALSO TO CITATION(S) 38615, 38990, 38991, 38992, 39005, 39377*

39062 **(ANL/CNSV-TM—116) Work plan for development of a data base on potential landfill-gas utilization sites in the United States.** (SCS Engineers, Inc., Covington, KY (USA)). Feb 1982. Contract W-31-109-ENG-38. 39p. NTIS, PC A03/MF A01. Order Number DE83014212.

In an attempt to determine the effects of the criteria established by the Resource Conservation and Recovery Act (RCRA) Section 4004's Open Dump Inventory (ODI) upon the establishment of landfill gas utilization projects, a national survey of landfills was taken. The project, quantified the gas utilization potential for landfills of various types and sizes across the United States. Preliminary information was collected through telephone or mail surveys of people dealing with solid waste disposal in each of the Environmental Protection Agency (EPA) Regional Offices and in each of the 50 states. In addition, visits to eight states were conducted to gather more detailed information and assess the quality of information collected in the preliminary step. The surveys attempted to elicit the following information about the prospective ODI in each state: (1) size, age, and type of each landfill; (2) status of gas control and utilization projects; and (3) location of landfill gas problem sites. In addition, the quality of information in each state's files and the accessibility of those files were evaluated.

39063 **(DOE/RA/50377—1) Cogeneration energy-recovery facility feasibility study: Nashville Thermal Transfer Corporation study.** (Nashville Electric Service, TN (USA)). Feb 1983. Contract FG01-80RA50377. 89p. NTIS MF A01. Order Number DE83013542.

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The feasibility of a refuse-fueled district heating system is examined. The following tasks of the survey are reported: energy market survey, analysis of waste storage and handling requirements, analysis of land requirements, analysis of crane operation, site layout, analysis of in-plant piping and auxiliaries, analysis of future plant operating modes and demands, evaluate condensing water system requirements, evaluate boiler feed pump requirements, evaluate water softeners and condensate polishing requirements, evaluate electrostatic precipitator requirements, evaluate distribution system, evaluate turbine generator, cost analysis, distribution system cost estimate, transfer facility cost estimate, commercial viability analysis, environmental analysis, and construction project schedule. (MHR)

39064 **(TVA/ONR/LFR—83/17) Industrial history of Hawkins County, Tennessee.** Wolfe, M.R. (Tennessee Valley Authority, Knoxville (USA)). 1983. 33p. NTIS, PC A03/MF A01. Order Number DE83902048.

Hawkins County encompasses an area of approximately 480 square miles and the 1980 census assigns it a population of 43,751, an increase of 10,025 over 1970. Since the establishment of its earliest settlements in the late 18th century, Hawkins County has been agricultural. Although the County is rapidly experiencing the effects of industrialization and urbanization the values and opinions of its people and its governmental machinery are to a considerable degree the remnants of a rural-based economy. Industrialization in Hawkins County has not been the result of steady unbroken progress. The stages are not clearly defined, but for purposes of organization three general chronological periods can be identified: (1) preindustrial society, 1786-1900; (2) early modern industrialization 1900-1940; and (3) contemporay industrialization, 1940 to the present. In less than a century, Hawkins County residents have experienced kaleidoscopic economic and technological change. A person born in the late 19th century who survived into the 1970s could testify to the presence of active water-driven mill wheels; the once heavy reliance on animal power for farming and transportation; the sight of flatboats and rafts on the Holston River; the coming of the Southern Railway and the Carolina, Clinchfield and Ohio Railroad; the establishment of the planned industrial city of Kingsport in neighboring Sullivan County; the appearance of the automobile and the demand for adequate roads; the creation of the Tennessee Valley Authority; and the recent proliferation of industry along U.S. Highway 11W, the County's principal transportation artery. The purpose of this study is to chronicle such developments and to suggest the social and economic implications of these changes.

39065 **A waste heat district heating system with seasonal variations.** Mahini, R.T.; Schrock, V.E. (University of California, Berkeley, CA 94720). *Transactions of the American Nuclear Society;* **43**: 35-36(1982). (CONF-821103—).

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

39066 **Regulatory and institutional issues: overview of federal policy and currents issues regarding the Public Utility Regulatory Policies Act.** Kessler, M. (Federal Energy Regulatory Commission, 825 North Capitol Street, N.W., Washington, DC 20426). *Transactions of the American Nuclear Society;* **43**: 33-34(1982). (CONF-821103—).

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

39067 **Combined electric and heat generation at coal-fired plants.** Oliker, I. (Burns and Roe, Inc., Oradell, NJ). pp 242-249 of Energy, resources and environment. Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). (CONF-821121—).

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

Performance and cost data for coal-fired district heating power plants of unit sizes 200, 400 and 800 MW have been developed and compared with similar data for single-purpose power plants of the same unit sizes and steam parameters. All the units examined have throttle steam conditions of 2400 psig and 1000/1000°F and seven stages of feedwater heating; the district heating turbines also have extractions necessary for district water heating in two stages. Electric and heat generating costs at the plant boundary have been developed for both types of units.

### 3209 Education And Public Relations

*REFER ALSO TO CITATION(S) 39043*

39068 **Evaluation of energy conservation workshops: attitudinal and behavioral outcomes.** Ferguson, J.F.; Bowen, S.P. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Materials and Society;* **7**: No. 2, 217-224(1983).

Results of this followup study indicate that information workshops can make a very apparent difference between those who attend and those who do not. Those who attend such programs may have self-selected themselves and are perhaps more future-oriented and responsive to price changes in energy than nonattendants. This followup study demonstrates that information dissemination and educational programming can contribute to broad and comprehensive differences in the behavioral responses to the outside stimuli of energy price and availability. The policy implication of this study for future government interventions on behalf of consumers in future crises is that education and information delivery can be effective in changing behaviors and in accelerating these changes.

## 33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

### 3301 Internal Combustion Engines

*REFER ALSO TO CITATION(S) 39075, 39076*

39069 **(CSS/CI—83-19) Spray characteristics of simplex swirl atomizers.** Rizk, N.K.; Lefebvre, A.H. (Purdue Univ., Lafayette, IN (USA). Combustion Lab. ). Dec 1982. 26p. (CONF-830358—17). Purdue Univ., School of Mechanical Engineering, Thermal Sciences and Propulsion Center, The Combustion Lab., West Lafayette, IN 47907.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

The effects of air and liquid properties, and atomizer dimensions, on the spray characteristics of simplex pressure-swirl atomiz-

ers are examined. Mean drop size and drop-size distribution are measured using an improved form of light-scattering technique. The test range includes wide variations in air pressure, atomizer flow number, liquid flow rate, liquid viscosity and injection pressure differential. The effects on mean drop size and drop-size distribution of variation in distance between the atomizer and the plane of measurement are also examined. The results show that increase in distance from the nozzle, beyond the minimum needed to complete the atomization process, produces both an increase in mean drop size and a broader distribution of drop sizes in the spray. In fact, it is generally observed that any change in air properties, liquid properties and atomizer geometry that lowers the mean drop size, also narrows the drop-size distribution in the spray. It is also shown that conventional power law expressions for describing the dependence of mean drop size on air and liquid properties are basically unsound and have only limited ranges of application.

39070 **(CSS/CI—83-21) Correlation of gas-turbine-combustor efficiency.** Leonard, P.A.; Mellor, A.M. (Purdue Univ., Lafayette, IN (USA). Combustion Lab. ). 1983. 31p. (CONF-830358—3). Purdue University, The Combustion Lab., West Lafayette, IN.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

A new model is proposed to correlate combustion efficiency from gas turbine combustors, including fuel type and atomization effects. The model includes two zones in which evaporation, mixing, and kinetic processes occur. Time scales are defined to model these processes, and an expression is written for combustion inefficiency in terms of these scales. Data for four combustors, and for fuels in the range from JP-4 to DF-2, are correlated. The model reproduces the primary empirical observations, and represents a significant extension of previously proposed correlations.

39071 **(DOE/CS/50209—T1) Fuel-Economy Marketing Information Project. Final report.** Hemphill, J.M. Jr. (Power (J.D.) and Associates, Westlake Village, CA (USA)). Mar 1981. Contract AC01-80CS50209. 66p. NTIS, PC A04/MF A01. Order Number DE83012973.

The Fuel Economy Information Program and the research study performed to evaluate its effectiveness are reviewed. The new vehicle purchase process and the demographics of the new car market are presented. The importance of various vehicle characteristics and the role of fuel economy in the decision process are discussed. Sources and consumer use of vehicle information, including information on fuel economy, and its implication for publicity are presented. The seminar outline and background information are included. (MHR)

39072 **(DOE/NASA/0008—79/6) Ceramic-regenerator-systems development program. Progress report, July 1-December 31, 1978.** Fucinari, C.A.; Lingscheit, J.N.; Vallance, J.K. (Ford Motor Co., Dearborn, MI (USA). Research Staff). Mar 1979. Contract AI01-77CS51040. 121p. (NASA-CR—159541). NTIS, PC A06/MF A01. Order Number DE83013285.

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The primary objectives of the DOE/NASA Ceramic Regenerator Design and Reliability Program is to develop ceramic regenerator cores that can be used in passenger car and industrial/truck gas turbine engines. The major cause of failure of early gas turbine regenerators was found to be chemical attack of the ceramic material. Improved materials and design concepts aimed at reducing or eliminating chemical attack were placed on durability test in Ford 707 industrial gas turbine engines late in 1974. The results of 10,745 hours of turbine engine durability testing accumulated during the period from July 1, 1978 to December 31, 1978 are reported. Two materials, aluminium silicate and magnesium aluminium silicate, continue to show promise. Three aluminium silicate cores have attained the durability objective of 10,000 hours at 800°C (1472°F). Another aluminium silicate core shows minimal evidence of chemical attack after 7632 hours at 982°C (1800°F). The results obtained during this period in ceramic material screening tests, aerothermodynamic performance tests, stress analysis, cost studies, and material specifications are also included.

39073 **(PB—83-142711) The effects of acceleration rate on vehicle exhaust emissions and fuel economy. Technical report.** Landman, L.C. (Environmental Protection Agency, Ann Arbor, MI (USA)). Aug 1982. 141p. NTIS, PC A07/MF A01.

This report summarizes a test program which was designed to explore the impact on exhaust emissions and fuel economy of coupling the dynamometer rollers (front and rear) and of using acceleration rates higher than those used on the Federal Test Procedure (FTP). A total of six vehicles were tested in this program. All five gasoline-fueled exhibited increases in hydrocarbons (HC) and carbon monoxide (CO) emissions on the Federal Test Procedure (FTP) driving cycle when the dynamometer rollers were coupled. The other results are strongly vehicle dependent.

## 3302 External Combustion Engines

*REFER ALSO TO CITATION(S) 39075*

39074 **(DOE/NASA/1005—1) Test results and description of a 1-kW free-piston Stirling engine with a dashpot load.** Schreiber, J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1983. Contract AI05-82OR21005. 21p. (NASA-TM—83407; CONF-830812—25). NTIS, PC A02/MF A01. Order Number DE83013343.

From 18. intersociety energy conversion engineering conference; Orlando, FL, USA (21 Aug 1983).

A 1 kW (1.33 hp) single cylinder free-piston Stirling engine was installed in the test facilities at the Lewis laboratory. The engine was designed specifically for research of the dynamics of its operation. Initial tests at Lewis showed the power level and efficiency of the engine to be below design level. Tests were performed to help determine the specific problems in the engine causing the below-design-level performance. Modifications to engine hardware and to the faciltity where performed in an effort to bring the power output and efficiency to their design values. As finally configured the engine generated more than 1250 watts of output power at an engine efficiency greater than 32 percent. This report presents the tests performed to help determine the specific problems, the result if the problem was eliminated, the fix performed to the hardware, and the test results after the engine was tested. In cases where the fix did not cause the anticipated effects, a possible explanation is given.

## 3303 Electric-powered Systems

*REFER ALSO TO CITATION(S) 38980*

## 3304 Hybrid Systems

*REFER ALSO TO CITATION(S) 38743*

## 3306 Vehicle Design Factors

39075 **(ANL/CNSV—38) Structural-ceramic research program: a preliminary economic analysis.** Johnson, L.R.; Teotia, A.P.S.; Hill, L.G. (Argonne National Lab., IL (USA)). Mar 1983. Contract W-31-109-ENG-38. 81p. NTIS, PC A05/MF A01. Order Number DE83014263.

Advanced power systems for vehicles can potentially produce fuel efficiencies that greatly exceed those of today's gasoline and diesel engines. Recent work has focused on adiabatic diesel engines, gas turbine engines, Stirling engines, and electric vehicle batteries. The heat engine technologies, however, are limited by problems involving mechanical strength at high temperatures. Structural ceramics, if they can be reliably mass-produced, can make possible improved vehicle fuel efficiencies through higher-temperature operation and reduced vehicle weight. In this report, the macroeconomic impacts (effects on gross national product, employment, fuel imports, and balance of trade) are modeled for two scenarios, one in which the US dominates the commercialization of ceramics in

heat engines throughout the 1990s and the other in which Japan dominates. The positive effects of US dominance were forecast to be substantially greater than the negative effects of foreign dominance due to two assumptions: (1) Japanese ceramic commercialization does not include the truck and stationary engine markets because of a lack of historical presence in these areas and (2) imports of Japanese cars with ceramic engines are legislatively limited to 30% of new car sales. Improved ceramics can also be substituted for superalloys containing strategic materials and thus reduce US dependence on foreign suppliers.

### 3307 Emission Control

*REFER ALSO TO CITATION(S) 39340*

### 3308 Alternative Fuels

39076 **(CONF-830358—22) Preliminary investigation of soot formation from multicomponent droplet combustion.** Randolph, A.L.; Law, C.K. (Northwestern Univ., Evanston, IL (USA). Dept. of Chemical Engineering). 1983. 24p. Northwestern Univ., Department of Chemical Engineering, Evanston, IL 60201.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

Soot formation from the combustion of isolated or interacting freely-falling multicomponent droplets in a hot oxidizing environment has been experimentally studied for the effects of droplet spacing, droplet size, fuel blending, and micro-explosion. Results quantify the long-range effect of droplet interaction, the reduction in soot resulting from blending ethanol in diesel, and the relative sooting tendencies of toluene and hexadecane which are representative components of diesel fuels. The preliminary data also indicate a linear relation between the extent of droplet soot formation and the initial droplet size, and a constant soot reduction factor due to microexplosion.

39077 **(CSS/CI—83-22) Prediction of the ignition limits of alcohol-hydrocarbon mixtures.** Murin, J.M.; Weller, A.E. (Battelle Columbus Labs., OH (USA)). Jan 1983. 32p. (CONF-830358—11). The Combustion Inst., Central States Section, P.O. Drawer 28510, San Antonio, TX 78284.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

An experimental program was undertaken to determine the effects of hydrocarbon additives on the ignition limits of alcohol fuels using methanol-isopentane and methanol-toluene mixtures. A fixed volume of the liquid fuel mixture, chosen to limit the change in liquid composition caused by differential vaporization, was introduced into a combustion bomb apparatus. The liquid was temperature-equilibrated to achieve an equilibrium fuel-vapor/air stoichiometry. A spark in the vapor volume provided the energy for ignition. Results of the ignition limit experiments for both the methanol-isopentane and methanol-toluene mixtures demonstrate that the mixture ignition limits can be predicted from a knowledge of the individual fuel limits and the vapor-liquid equilibrium composition of the mixture. The average difference between the predicted and measured temperature ignition limits for both fuel mixtures was 1.7 C. Both the experimental procedures used to obtain the ignition limits of the mixtures and the methodology used to predict the ignition limits of the mixtures are discussed.

39078 **(SAN—2184-T1) Potential role of the distilling industry in supplying ethanol fuel.** White, H.M. (Aerospace Corp., El Segundo, CA (USA)). Jan 1979. Contract AC03-78CS52184. 40p. NTIS, PC A03/MF A01. Order Number DE83013457.

The role that the distilled spirits industry could play in supplying fermentation-derived ethanol as an alternative transportation fuel is assessed. The main characteristics of this complex industry are reviewed, and the near-term potential for expanded production is evaluated. A description of the fermentation processes that are used to make ethanol from various renewable raw materials is given. The several segments of the distilling industry, especially the Kentucky distilleries and Midwest large-scale alcohol producers, are reviewed as to their major features. Based on telephone interviews and plant visits, the major findings of the study are presented, particularly the capability of the industry to produce anhydrous ethanol for use in alcohol-gasoline blends.

## 36 MATERIALS

39079 **(CONF-830474—) Critical and strategic materials proceedings of the laboratory study group meeting.** (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Jun 1983. 200p. NTIS, PC A09/MF A01. Order Number DE83013855.

From Critical and strategic materials laboratory study group meeting; Idaho Falls, ID, USA (12 Apr 1983).

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These Proceedings serve to identify the appropriate role for the DOE-BES-DMS Laboratory program concerning critical and strategic materials, identify and articulate high priority DOE-BES-DMS target areas so as to maximize programmatic responsiveness to national needs concerning critical and strategic materials, and identify research, expertise, and resources (including Collaborative Research Centers) that are relevant to critical and strategic materials that is either underway or in place under the DOE-BES-DMS Laboratory program. Laboratory statements of collaborative research are given.

39080 **(DOE/ER/10004—5) Final report on the management and use of DOE-provided discretionary funds for the period May 1978 to May 1983.** Stukel, J.J. (Illinois Univ., Urbana (USA). Office of Energy Research). Jun 1983. Contract AC02-78ER10004. 235p. NTIS, PC A11/MF A01. Order Number DE83013652.

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During the 5-year program, 25-energy-related projects were initiated; an effort was undertaken on the materials problems of coal utilization, and a new gaseous testing facility was created. The projects included laser surface alloying, laser processing of cast iron for enhanced erosion resistance, creep-fatigue-environment interactions in pressure vessel steels, and carburization and internal oxidation of materials for high-temperture coal gasification and liquefaction. (DCL)

### 3601 Metals And Alloys

*REFER ALSO TO CITATION(S) 38336, 38424, 38425, 38425, 38510, 38900, 38907, 38909, 38913, 39230, 39508, 39742*

39081 **(AERE-R—10523) Small angle neutron scattering (SANS) from heat treated PE16 specimens from Berkeley Nuclear Laboratories.** Windsor, C.G.; Rainey, V.S. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). Jun 1982. 30p. Availbale from H.M. Stationery Office, price Pound2.00.

Results are presented on the small angle neutron scattering from a set of 12 PE16 nickel based super alloy specimens received from the CEGB Berkeley Nuclear Laboratories. They include a solution treated and quenched specimen and samples heat treated to 700°C for times between 16 and 10,000 hours. The quenched specimen showed some scattering from particles of up to 24 nm diameter. This was assumed to be from carbide precipitates present in all specimens. All heat treated specimens show a further prominent precipitate. It can be identified as arising from the $\gamma'Ni_3(Ti,Al)$ precipitate from its mean size, which grows roughly as the cube of the heat treatment time, reaching a mean diameter of 35 nm at 500 hours. The spectrometer upper size resolution of 40 nm affected the results of longer heat treatment times. The precipitate volume fraction is less well determined because of the uncertainty in the precipitate atomic composition. A $\gamma'$ precipitate of the form Nisub(0.75)Alsub(x)Tisub(0.25-x) is assumed with x measured by energy dispersive electron microscopy.

**39082 (BNL—33025) Electrochemical behavior of pits developed on aluminum in a dilute chloride solution.** Ishikawa, Y.; Isaacs, H.S. (Hitachi Ltd., Tokyo (Japan); Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 5p. (CONF-830575—1). NTIS, PC A02/MF A01. Order Number DE83013115.

From Spring meeting of the Japan Society of Corrosion Engineers; Tokyo, Japan (18 May 1983).

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Electrochemical behavior of pits developed on aluminum in 30 ppM chloride ion solution was measured by the recently developed scanning vibrating electrode technique (SVET) and compared with that of the total exposed surface. It was found that the pit showed markedly different polarization characteristics compared with the total surface owing to the very different environment and electrochemistry within the pit. Furthermore it was shown that the size of the pit strongly affected the cathodic activity of the pit because of the diffusion effect. An attempt was made to relate the growth rate of the pit to the variation of the open circuit potential of the total surface.

**39083 (BNL—33059) Study of pitting corrosion of aluminium by means of the scanning vibrating-electrode technique.** Ishikawa, Y.; Isaacs, H.S. (Brookhaven National Lab., Upton, NY (USA); Hitachi Ltd., Tokyo (Japan)). 1983. Contract AC02-76CH00016. 22p. NTIS, PC A02/MF A01. Order Number DE83013065.

The pitting behavior of aluminum was measured in 10 to 30 ppM chloride ion and with four inhibitors (acetate, nitrate, phosphate and sulfate) in the range 10 to 70 ppM. Initiation, growth and repassivation of pits were monitored by SVET and the potentiodynamic polarization behavior of specific pits was examined. All the inhibitors were ineffective in repassivating pits developed prior to cathodic polarization. Nitrate and sulfate appeared to prevent pit growth after cathodic protection of developed pits. However, phosphate tended to accelerate the pitting corrosion, while acetate did not show a significant effect. 9 figures.

**39084 (CEA-CONF—6393) Adiabatic shearing study by dynamic compression.** Dormeval, R.; Stelly, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Jul 1982. 15p. (In French). (CONF-820779—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702043.

From CESMI meeting on dynamic testing of materials and structures at high strain-rates; St. Quen, France (5 Jul 1982).

The adiabatic shearing study was carried out by dynamic compression tests made on a Hopkinson's rod. The deformation rate is around $2 \times 10^3\ s^{-1}$; the materials studied are in martensitic steel and a titanium alloy, at ambient temperature and up to 500°C. Microscopic observations show how the break appears, associated with the development of adiabatic shearing bands. The mechanical results are discussed and compared against the theoretical approaches.

**39085 (CEA-CONF—6446) Neutron investigations of the charge density wave in α-uranium.** Marmeggi, J.C.; Lander, G.H.; Vettier, C.; Delapalme, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1982. 10p. (CONF-820935—9). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702044.

From 6. Yamada conference on neutron scattering of condensed matter; Tokyo, Japan (1 Sep 1982).

In this paper we report on an experiment to measure the intensities of 240 first-order satellites discovered at low temperature in α-U and having an incommensurable wave vector q [0.5, 0.176, 0.182]. Details of the model based on the displacements along the three crystallographic axes and some of its possible short-comings are presented.

**39086 (DOE/ER/01198—1399) Electron-tunneling study of superconductors doped with magnetic atoms and nonmagnetic resonant-state atoms: indium-chromium, zinc-manganese, and aluminum-manganese.** Terris, B.D. (Illinois Univ., Urbana (USA). Dept. of Physics). 1983. Contract AC02-76ER01198. 127p. NTIS, PC A07/MF A01. Order Number DE83013433.

Thesis.

We have used electron-tunneling measurements to determine the density of states of quench-condensed thin films of In-Cr, Zn-Mn, and Al-Mn, and of annealed thin films of Zn-Mn. The results on In-Cr and Zn-Mn were compared with Shiba's theory for magentic atoms in superconductors. We observed the localized band of states predicted to form in the energy gap of such alloys, though the observed band was broader than that predicted. The annealed samples of Zn-Mn showed a narrower band than did the quench-condensed samples. Reasonable agreement with Shiba's theory was found if s, p, and d wave scattering were included. The results on Al-Mn were compared with Salomaa and Nieminen's theory for nonmagnetic resonant-state atoms in superconductors. The predicted band of states was not observed. Our measurements indicate that Mn in quench-condensed Al is nonmagnetic. Any resonant states which do exist in the superconducting alloy are too broad to be seen in our tunneling measurement.

**39087 (DOE/ER/01198—T2) Tunneling and migration of the dumbbell defect in electron-irradiated aluminum-zinc alloys.** Wallace, P.W. (Illinois Univ., Urbana (USA). Dept. of Physics). 1983. Contract AC02-76ER01198. 100p. NTIS, PC A05/MF A01. Order Number DE83013651.

Thesis.

Ultrasonic attenuation and velocity measurements on irradiated Al-Zn alloys (0.01, 0.1, and 0.5 at %) indicate a tunneling relaxation of the predominant mixed dumbbell defect at low temperatures, and mixed dumbbell migration at the Stage II anneal temperature. The effect of an internal strain varying with the zinc concentration on the measured decrement and modulus change is striking. Evaluated in the framework of a six-level system, this reveals the simultaneous action of resonance and nonclassical relaxation processes. Using Fe as a probe atom, it is shown that mixed dumbbell dissociation is in an insignificant component of the annealing of this defect. The decrease of the annealing temperature at higher zinc concentrations provides evidence that the mixed dumbbell migrates as a unit during annealing. The energies associated with dumbbell migration and interstitial escape are derived. Further evidence for the migration mechanism is obtained from successive irradiation and annealing.

**39088 (ECN—118) Short-range clustering and decomposition in copper-nickel and copper-nickel-iron alloys.** Aalders, T.J.A. (Stichting Energieonderzoek Centrum Nederland, Petten; Rijksuniversiteit Utrecht (Netherlands)). Jul 1982. 140p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83701646.

Portions are illegible in microfiche products. Original copy available until stock is exhausted6 figs., 6 tables, 111 refs.

The thermodynamic equilibrium state of short-range clustering and the kinetics of short-range clustering and decomposition has been studied for a number of CuNi(Fe)-alloys by means of neutron scattering. The validity of the theories, which are usually applied to describe spinodal decomposition, nucleation and growth, coarsening etc., was investigated. It was shown that for the investigated substances the conventional theory of spinodal decomposition is valid for the relaxation of short-range clustering only for the case that the initial and final states do not differ too much. The dynamical scaling procedure described by Lebowitz et al. did not lead to a time-independent scaled function F(x) for the relaxation of short-range clustering, for the early stages of decomposition and for the case that an alloy, which was already decomposed at the quench temperature $T_1$, was annealed at a temperature $T_2(T_1)$. For the later stages of decomposition, however, the scaling procedure was indeed successful. The coarsening of the alloys could, except for the later stages, be described by the Lifshitz-Slyozov theory.

**39089 (FEI—1311) Calculations of the lattice dynamics of the disordered vanadium-oxygen alloys in the Rafizade model.** Danilkin, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701903.

Expressions for the dynamic matrice elements for Vsub(1-x)Osub(x) (x = 0.17 and 0.03) alloys in the Raphizade model with

account for vanadium-vanadium and vanadium-oxygen interaction in two coordination spheres and oxygen-oxygen interaction only of the nearest neighbours. The Vsub(i-x)Osub(x) dispersion curves are calculated for various concentrations of implanted atoms and various constant values of oxygen atom interaction. The applicability of the Raphizade model for describing the lattice dynamics of the disordered Vsub(i-x)Osub(x) solid solutions is analysed and the value of oxygen atom interaction is evaluated.

39090 **(HEDL-SA—2687-A) Microchemical evolution and swelling of AISI 316 irradiated in HFIR and EBR-II.** Brager, H.R.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Mar 1983. Contract AC06-76FF02170. 5p. (CONF-821049—24). NTIS, PC A02/MF A01. Order Number DE83012717.

From TMS/AIME fall meeting(Radiation damage analysis for fusion reactors); St. Louis, MO, USA (24 Oct 1982).

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The radiation-induced evolution at 500 to 700°C was examined for both annealed and cold-worked AISI 316 in EBR-II and HFIR. While some details of the phase evolution change in response to differences in neutron spectra, the dislocation development and the major facets of the microchemical evolution of the matrix are unchanged. Despite the increased cavity densities generated in HFIR, total swelling appears to be unaffected by increased levels of helium and solid transmutants.

39091 **(IAE—3422/10) Study on electrophysical properties off $Nb_3Sn$-based tape superconductors.** Davlat'yan, T.A.; Dudin, V.I.; Kuznetsova, V.G.; Mikhajlov, N.N.; Seregin, B.M.; Smirnova, M.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701949.

Portions are illegible in microfiche products3 refs.; 15 figs.; 3 tabs.

The results of measurements of electrophysi al properties of $Nb_3Sn$-based standard superconductors (SC) are presented. Volt-ampere and volt-temperature characteristics (VAC and VTC) of tape SC of 5 mm width with a superconducting layer of 5 μm thickness and 25 μm copper substrate thickness are presented. The specific features of both characteristics is their "lengthiness". This circumstance requires application of a two-coordinate technique of VAC and VTC measurement and introduction of their functional description. VAC description by "critical current" i. e. by a single point is unsatisfactory. The investigated SC anisotropy parameter K=Isub(c parallel)/Isub(c perpendicular) < 1, which makes VAC of the $Nb_3Sn$ tape SC in a perpendicular to a wide tape side magnetic field strongly "lengthy". Local reduction of the current-carrying capability of some samples, existence of VAC jumps, appearance of VAC jumps at sample tension are due to "narrow" defect areas which can be found by means of a continuous control of SC magnetization. The two-dimensional character of current overflow on the SC layer+normal metal is also a reflection of SC property heterogeneity over its length and width. The performed investigations of electrophysical properties of $Nb_3Sn$ tape SC as well as study on design of superconducting magnetic systems from these SC prove the necessity in control of uniformity of current carrying capability of tape SC over their length.

39092 (IAEA-TECDOC—263, pp 185-192) **Displacement damage calculations with ENDF/B-V.** Greenwood, L.R.; Smither, R.K. (Argonne National Lab., IL (USA)). Apr 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811070—).

From IAEA advisory group meeting on nuclear data for radiation damage and safety; Vienna, Austria (12 Oct 1981).

Neutron displacement damage cross sections have been calculated for 30 elements using nuclear cross sections from ENDF/B-V. Six elements have been extended to 44 MeV for accelerator-based neutron sources. Spectral-averaged damage cross sections are found to agree within 10% of those calculated previously using ENDF/B-IV. Nuclear data is needed to improve the quality of the files and to provide for error assignments. The treatment of some reactions also needs improvement, especially (n,γ), β-decay, and secondary-particle emission above 14 MeV.

39093 **(IC—81/160) Self-consistent theory of localization in binary alloys.** Brezini, A.; Olivier, G. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1981. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701648.

The self-consistent theory of localization of Kumar et al. is applied to the case of binary alloys. Two approximations are presented in the limit of small concentration (c=0.1). The second one appears in good agreement with the results predicted by other theories.

39094 **(IC—81/198) Model of the ice-d electron metal interface.** Painter, K.R.; Grout, P.J.; March, N.H.; Tosi, M.P. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701649.

A qualitative explanation of the different orientations of the growth of ice on Pt (111) and Ag (111) surfaces is proposed. Other physical consequences which follow are discussed and experiments are suggested to test these.

39095 (INIS-SU—145, pp 199-204) **Channeled particle focusing.** Ryabov, V.A.; Cherdyntsev, V.V. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

Computer calculations of the proton axial channeling in W thin crystals are conducted. An attempt is made to evaluate the minima of the backscattered beam intensity under the condition of beam focusing by two adjacent atomic rows with account of a certain potential and diffusion in the transverse plane.

39096 (INIS-SU—145, pp 157-161) **Orientational effects in the interaction between low-energy electrons and tungsten monocrystal.** Gomoyunov, M.V.; Zaslavskij, S.L.; Pronin, I.I. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

An experimental investigation of orientational effects for W(100) monocrystal under irradiation of its surface by electrons with Esub(p)=0.5-1 keV energy is conducted. The effect of diffraction channelling of incident electrons on the emission of secondary electrons (SE) belonging to different sections of the spectrum and having different nature is studied. It results from the obtained experimental data that the orientational dependence of the secondary electron emission from W(100) is observed within the whole range of their energy change. These orientational effects should be necessarily taken into account in quantitative electron Auger-spectroscopy measurements.

39097 **(INR—1914) Technical devices based on the InSb-NiSb eutectic.** Modrzejewski, A.; Slepowronski, M.; Warchol, S. (Institute of Nuclear Research, Warsaw (Poland)). 1981. 27p. (In Polish). Available from Energetics and Atomic Energy Information Centre, Warsaw, Poland.

The magnetoresistance effect, the photoelectromagnetic effect and the Ettingshausen-Nernst effect, limited in a homogeneous InSb by internal voltage coupled with electron transport, can be enhanced for directionally solidified InSb-NiSb eutectic because of short circuiting of these voltages in the direction of the NiSb needles and the related secondary effects. The technical devices like: magnetoresistors, contactless potentiometers, contactless speed meters of rotational and linear movement, dc brushless motors, infrared detectors and other arrangements can be constructed using this material.

**39098 (JINR—E-14-82-461) Coupled quadrupole-phonon excitations: inelastic neutron scattering on Van Vleck paramagnet $PrNi_5$.** Aksenov, V.L.; Gremychkin, E.A.; Muhle, E.; Buhrer, W.; Frauenheim, Th. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701908.

From International conference on neutron scattering of condensed matter; Tokyo (Japan) (1982).

Inelastic neutron scattering experiments on a single crystal $PrNi_5$ (0.4 $cm^3$) were performed at the sample temperature T=8 K. The dispersion relations of the acoustic transverse phonons and the low-energy magnetic excitations were measured in the T and Δ-directions. An analysis of the intersection region of these excitations shows that an additional neutron intensity to the neuclear and magnetic dipolar scattering occurs due to magneto-elastic scattering. The hybridized spectra of phonons and quadrupole excitons are discussed.

**39099 (JINR-R—3-81-843) Observation of neutron direct effect on ferrite residual magnetization.** Vasil'eva, Eh.V.; Vasil'ev, B.V.; Nazarov, V.M.; Chan Khan' Maj. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701911.

By means of a high efficiency superconducting quantum interferometer, the direct change in the residual magnetization caused by neutrons through the (n, α) reaction mechanism is discovered. The observed decrease in magnetization with time is qualitatively coincident with the temporal dependence of heat release in a sample.

**39100 (JINR-R—8-81-490) Direct measurement of transverse resistance of composite superconductors.** Drobin, V.M.; D'yachkov, E.I.; Luppov, V.G.; Nikitiu, A.; Khukhareva, I.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701951.

9 refs.; 7 figs.; submitted to the journal Cryogenics.

Techniques for direct measUrement of transverse resistance of composite superconductors is developed. The measurements were carried out at 4.2 K, 12 K and 300 K in magnetic field upto 6 T on finely divided superconducting wires with N -Ti cores of 10 μm diameter in copper matrix. On the basis of resistance values obtained vortex losses have been calculated and compared with losses measured by the calorimetric method.

**39101 (JINR-R—14-82-265) Recrystallization study of copper bars by neutron diffraction at a pulsed reactor.** Matz, W.; Feldman, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701909.

Recrystallization texture development of axisymmetric copper bars is studied immediately during recrystallization process by the neutron time-of-flight diffraction. A constant heating temperature of 225 deg C has been chosen to finish the recrystallization process after 35 h. In 2 h period diffraction spectra were measured. Quantitative texture analysis of initial and final state of this sample has been done on the base of angle dispersion measurements at stationary reactor. The deformation texture of initial state is built up from (100) and (111) components. During recrystallization the intensity of (200) reflection increases, but (111)-reflection decreases. The intensity of (311) and (422) peaks decreases also. These reflections are placed on the connection line between (111) and (100) points of the inversed pole figure.

**39102 (JINR-R—14-82-458) Magnetic exciton line widths in cubic compounds of the Laves phase $PrAl_2$, $PrNi_2$.** Aksenov, V.L.; Goremychkin, E.A.; Frauenkha m, T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701910.

On the base experimental data on neutron inelastic scattering a temperature dependence of line widths of localized magnetic excitations in rare earth's intermetallics $PrAl_2$ and $PrNi_2$ by means of s-f exchange model is considered. Results obtained an compared with theoretical over.

**39103 (KFK—3445) Iodine-induced stress corrosion cracking in zircaloy-4 tubing and fracture mechanics analysis at high temperatures.** Eckstein, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Dec 1982. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83750678.

The failure behavior is determined mainly by two processes: (a) plastic creep strain in the whole cladding wall which takes place predominantly during the crack formation phase; and (b) crack propagation which is influenced by the temperature-dependent transport velocity of gaseous iodine and its tendency to be adsorbed at the crack tip. The temperature-dependent combination of the two processes and additional local plastic strains in the vicinity of the crack front (600°C), determine the strain and time-to-failure behavior. The failure behavior of iodine-containing Zry-4 cladding tubes from 500 to 700°C can be described by the elastic-plastic fracture mechanics model CEPFRAME. The model includes an empirically-determined computation method for the crack formation time, as well as an elastic-plastic model for describing stable crack growth due to iodine-induced SCC. The crack formation time is a temperature-dependent function of both the depth of surface damage and the load.

**39104 (KFKI—1982-73) Crystallization of Fe-P amorphous alloys as studied by EDXD method.** Hiltunen, E.; Takacs, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701652.

8 refs.; 9 figs.

The crystallization of Fe-P amorphous alloys was studied by using energy dispersive X-ray diffraction (EDXD), thermomagnetic and Moessbauer measurements. Especially EDXD proved to be useful, because its very short exposure time enabled us to perform isothermal crystallization measurements under a practically continuous control by diffraction spectra. By measuring the intensity of the appropriate diffraction lines, the crystallization kinetics of each phase could be recorded simultaneously. At 610K the crystallization of an Fesub(81.2)Psub(18.8) amorphous alloy was found to start within 5 minutes as the primary crystallization of α-Fe. This step is followed by the eutectic crystallization of the stable phases α-Fe and $Fe_3P$.

**39105 (LBL—16089) High-temperature corrosion of iron and iron-based alloys in sulfur-containing atmospheres.** Yang, F.C. (Lawrence Berkeley Lab., CA (USA)). Apr 1983. Contract AC03-76SF00098. 147p. NTIS, PC A07/MF A01; 1; Thesis. Order Number DE83013843.

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The corrosion morphology, kinetics, and mechanism of the attack on metals and some iron-based alloys by sulfur-containing atmospheres are studied at 871°C. In the case of pure iron, protrusions with sulfide-rich cores are observed on the scale surface. This morphology is explained by the fast transport of iron ions through the sulfide-rich streaks. Models of unbalanced diffusion are proposed to account for the formation of an inner porous layer. The addition of alloying elements, such as Al and Cr, improves the corrosion resistance by forming a protective $Al_2O_3$ or $Cr_2O_3$ oxide scale. However, sulfur penetration through the scale and its effect on the spalling resistance of the oxide scale can lead to the onset of a catastrophic corrosion and rapid failure of the alloys. The transport of sulfur through scales, the thermodynamic conditions for the formation of duplex oxide-sulfide scales and the influence of alloying elements are discussed. It is concluded that sulfur penetration through both performed and growing $Al_2O_3$ and $Cr_2O_3$ scales resulting in an accelerated attack is inevitable. Nevertheless, ways of slowing down the attack are recommended.

**39106 (NRCN—475) Positron annihilation in single crystals of $TiO_2$, $VO_2$, Pb, and U.** Blau, M. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev; Hebrew Univ., Jerusalem (Israel). Dept. of Physics). Sep 1982. 103p. (In Hebrew). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83701653.

English reproduction of two pertinent publications included.

Two positron annihilation set-ups for Doppler broadening correlation measurements are described. The Doppler broadening spectra were measured in different directions of single crystals of $TiO_2$ and $VO_2$, at room temperature. The anisotropy was explained using two models in which the positron behaves as a free or bounded particle, and was related to the effective charge on the oxygen ion. The changes in the spectra in $VO_2$, on passing from the insulator to the metal phase, were found to be gradual and small. The results indicate that the main contribution to the metal-insulator transition is due to changes in the relative occupation of the oxygen p-states and not to changes in covalency or screening. Angular correlations were measured in single crystals of lead in three crystallographic directions. The derivatives of the spectra were compared with the Fermi surface obtained from dHvA measurements, using plane-wave electrons. Most of the features of the experimental derivatives were explained with this simple model. Angular correlation measurements were made on single crystals of uranium in two crystallographic directions. The derivates of the spectra were very wide with a few peaks.

**39107 (RFP—3455) Further abbreviation of the machining schedule for producing surface-damage-free beryllium.** Beitscher, S.; Johns, W.L.; Corle, R.R.; Luckow, J.R.; Hoover, S.A.; Grimes, A.G. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 25 Mar 1983. Contract AC04-76DP03533. 18p. NTIS, PC A02/MF A01. Order Number DE83010361.

An investigation was performed to evaluate the feasibility of reducing the number of finishing lathe cuts in the machining of Be that must be free of surface damage after subsequent heat treating or etching. Tensile, impact, and bend tests were used to determine the effects of surface damage on the mechanical properties. Optical and electron microscopic examinations were used to determine the metallographic effects of surface damage. Four different machining schedules were evaluated. Results indicate that a carefully controlled one-finishing pass method is equivalent to the carefully controlled two-finishing pass method presently being used to produce damage-free Be Rocky Flats SEM show periodic sharply and deeply cracked or torn regions of metal about 1/2 mil or 10 μm wide along the machining striations, evidences of microcracking.

**39108 (RFP—03388) Changes in acoustic emission peaks in precipitation strengthened alloys with heat treatment.** Heiple, C.R.; Carpenter, S.H. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1983. Contract AC04-76DP03533. 13p. NTIS, PC A02/MF A01. Order Number DE83013611.

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Acoustic emission was measured during tensile deformation in a number of precipitation-strengthened alloys as a function of prior heat treatment. The alloys tested included 7075, 6061, and 2219 aluminum; a modified A-286 stainless steel (JBK-75) and an experimental beryllium-containing stainless steel; and Incoloy 903. A rms voltage peak was observed in all the alloys near the onset of plastic flow, and a second peak was usually observed in 7075, 2219, and Incoloy 903 at plastic strains greater than 1%. Some evidence of a second peak was also observed in 6061 aluminum. Changes with heat treatment in the stress and strain at which the second peak occurred were consistent with the peak arising from the fracture of inclusions. The shifts in the location of the peak were in a direction so as to make the stress on the inclusions at the second peak relatively insensitive to prior heat treatment. The amplitude distributions of acoustic emission signals were also consistent with this interpretation. The strain at which the first acoustic emission peak occurred also varied with heat treatment, but the dependence of peak location on prior aging was different for the various alloys.

**39109 (SAND—83-1218C) Ion channeling and TEM studies of pulse-melted Fe(Pd) alloys.** Knapp, J.A.; Follstaedt, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 16p. (CONF-830570—2). NTIS, PC A02/MF A01. Order Number DE83012870.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

Metastable Fe(Pd) surface alloys formed by deposition of layers of Pd on (100) Fe and subsequent pulsed (~ 70 nsec, 1.9 J/cm²) electron beam melting into the bcc substrate have been investigated by ion backscattering/channeling and TEM. Repeated pulsed melting allowed examination of the epitaxial growth of the bcc substrate phase into the alloyed region for successively lower Pd concentrations. This procedure permitted detailed examination of the conditions for solidification with the fcc or bcc crystal structure and for metastable phase formation during rapid solidification. Bcc epitaxy is absent at Pd concentrations ≧ 30 at. %, where an fcc surface layer forms. Channeling of the Pd and Fe signals was observed at Pd concentrations ≦ 16.5 at. %, where a single-phase, supersaturated bcc alloy is observed. At an intermediate Pd concentration of 22 to 23 at. %, both epitaxial bcc and fcc materials are formed. The observed maximum substitutional Pd concentration in the bcc phase is about a factor of 5 greater than the maximum equilibrium solid solubility.

**39110 (UCRL—89034-Rev.1) Thermal stability of four high-strength, high-conductivity copper sheet alloys.** Dalder, E.N.C.; Ludemann, W.; Schumacher, B. (Lawrence Livermore National Lab., CA (USA)). 26 Apr 1983. Contract W-7405-ENG-48. 57p. (CONF-830466—5-Rev.1). NTIS, PC A04/MF A01. Order Number DE83013312.

From DOE workshop on copper alloys; Washington, DC, USA (14 Apr 1983).

Object is to determine the effects of the thermal treatments used during diffusion bonding, forming, and tritiding 50-cm-dia. RTNS-II targets on the room-temperature tensile properties of Amzirc, MZC, Elbrodur RS, and Glid-Cop copper alloy sheets of 0.04-in. thickness. The MZC sheet supplied to LLNL appears to have been improperly manufactured. The Amzirc sheet supplied to LLNL appears to have thermal-stability properties comparable to those exhibited by the Amax-processed product. The most likely explanation for the observed loss of strength is recrystallization. Elbrodur RS softens at 120°C higher than either Amzirc or MZC. Glid-Cop sheet exhibited excellent thermal stability, most likely due to the effectiveness of the inert $Al_2O_3$ dispersion in inhibiting recrystallization. 48 figures, 2 tables.

**39111 Surface segregation measurements during electron irradiation.** Muroga, T.; Okamoto, P.R.; Wiedersich, H. (Argonne National Lab., IL (USA)). *Radiation Effects Letters;* **68**: No. 6, 163-167(Feb 1983).

The growth of $Ni_3Si$ surface films on Ni-12.7at% Si alloys has been measured during 1 MeV electron irradiation. Stereoscopic techniques were used to determine film thickness from dark field images formed from $Ni_3Si$ superlattice reflections. Parabolic growth kinetics are observed at lower temperatures. However, at higher temperatures, deviations from parabolic kinetics are observed after short irradiation times. Such deviations have not been observed in bulk specimens during bombardment with energetic ions and, therefore, may be due to foil thickness effects.

**39112 Thermal propagation and stability in superconducting films.** Gray, K.E.; Kampwirth, R.T.; Zasadzinski, J.F.; Ducharme, S.P. (Argonne National Lab., IL (USA)). *Journal of Physics F: Metal Physics;* **13**: No. 2, 405-430(Feb 1983).

Thermal propagation and stable hot spots (normal domains) are studied in various high Tsub(c) superconducting films ($Nb_3Sn$, Nb, NbN and $Nb_3Ge$). A new energy balance is shown to give reasonable quantitative agreement of the dependence of the propagation velocity on the length of short normal domains. The steady state (zero velocity) measurements indicate the existence of two distinct situations for films on high thermal conductivity (sapphire) substrates. For low power per unit area the film and substrate have the same temperature, and the thermal properties of the substrate dominate. However, for higher power densities in short hot spots,

the coupling is relatively weak and the thermal properties of the film alone are important. Here a connection is made between the critical current stability of superconducting films and a critical hot spot size for thermal propagation. As a result efficient heat removal is shown to dominate the stabilisation of superconducting films. The strong and weak coupling situations also lead to modifications of the models for propagation velocities on sapphire substrates. Self-healing of hot spots and other phenomena in superconducting film are explained. The potential use of the thermal propagation model in applications of superconductors, especially switches is discussed.

**39113 Stress corrosion cracking of Zircaloy by cadmium, iodine, and metal iodides.** Shann, S.H.; Olander, D.R. (California Univ., Berkeley (USA). Dept. of Nuclear Engineering; Lawrence Berkeley Lab., CA (USA). Materials and Molecular Research Div.). *Journal of Nuclear Materials;* 113: No. 2/3, 234-248(Jan 1983).

In order to examine the cause of the reactor fuel pin pellet-cladding interaction phenomenon (PCI), stress corrosion cracking (SCC) experiments of Zircaloy under iodine, iron iodide, aluminum iodide, cesium iodide, and cadmium were undertaken. The rupture lifetime was measured as a function of stress, temperature, and the equivalent pressure of the corrosive agents. Tests with CsI and simultaneous irradiation were also performed to check whether radiation decomposition can induce Zircaloy SCC. Iodine, iron iodide, and aluminum iodide substantially reduced the failure times in comparison to those of control specimens at the same stress and temperature. A critical stress of approx.= 379 MPa for iodine and iron iodide separates burst type failure from low-stress and temperature. A critical stress of approx.= MPa for iodine and iron iodide separates burst type failure from low-stress short-alit failures. Both types showed brittle cleavage fracture surfaces. The presence of cesium iodide did not have any influence on the failure time of Zircaloy. The failure was burst-type, and the fractography was ductile. Simultaneous radiation tests with cesium iodide did not cause reduction in failure time either. All specimens failed under cadmium vapor by a burst mode, but the fractography showed cleavage brittle characteristics and the failure times were much smaller than those of control specimens.

**39114 Sourcebook of titanium alloy superconductivity.** Collings, E.W. New York, NY; Plenum Press (1983). 543p. (DOE/NBM—3010334). Plenum Press, 233 Spring Street, New York, NY 10013. Contract W-7405-ENG-92.

The first chapter provides a complete literature survey in tabular form. The next 13 chapters treat particular alloy classes in depth: unalloyed Ti; Ti-V binary alloys; binary Ti alloys with Cr, Mn, Fe, Co, or Ni; bionary Ti alloys with 4d and 5d transition elements; ternary Ti alloys with simple metals and transition metals except Nb; Ti-Nb binary alloys; Ti-Nb and Ti-Nb-base alloys containing B, C, N, or O additions; ternary alloys of Ti-Nb with simple metals; Soviet technical alloys; Ti-Zr-Nb ternary alloys; Ti-Nb-base ternary transition metal alloys; Ti-Nb-base quaternary alloys; and amorphous Ti alloy superconductors. (DLC)

**39115 (BG-Trans—5926) Corrosion in hot water heating installations.** Boeche, A.; Tevarotto, C. Translated from *Installatore Italiano ;* 32: No. 12, 1609-1618(Dec 1981). 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83901772.

An outline is given of the electrochemical processes and conditions which promote the formation of the anodic and cathodic zones producing corrosive phenomena in metals in contact with aqueous solutions, which may or may not contain dissolved oxygen. This is followed by an examination of the components of heating installations both on the inside, or water side, and on the outside, and the most common locations and circumstances of corrosion are described. The prime causes of oxygen enrichment are often the result of errors in design or installation and, giving a few of the most common examples, some possible corrective action is suggested. After taking a brief look at the behavior of aluminium components in the light of present knowledge, the causes of the external corrosion of piping and the flue-gas side of boilers is considered. In the conclusions, while mentioning the possibility of treating the water used in these installations, as also suggested by Standard UNI-CTI 8065, the advisability of always consulting technical experts in the field is stressed.

**39116 (K-Trans—207) Catalytic decomposition of hypophosphites. 9. Deposition of Cu coatings from ethylenediamine solution.** Lunyatskas, A.M.; Gyanutene, I.K.; Prokopchik, A.Yu. Translated from *Lietuvos TSR Mokslu Akademijos Darbai, Serija B: Chemija, Technika, Fizine Geografija ;* 3: No. 66, 123-129(1971). Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE83013571.

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The possibility of depositing Cu coatings through reduction of $[Cu(En)_2]^{2+}$ with hypophosphite at a temperature of 70 to 90°C was demonstrated. The process of copper-plating takes place at a rate of 1 to 3 milligrams/cm²/hour on the surface of frosted glass activated with PdCl. The optimum composition of the solution (moles/liter) is: $Cu^{2+}$ - ~ 0.1, En - ~ 0.6, $H_2PO_2^-$ - ~ 0.5; pH - ~ 12. It was established that the content of P in the coatings is less than 0.05%. $H_2$ is not given off in the copper-plating process, and utilization of hypophosphite is very good. Part of the hypophosphite is oxidized to phosphate during the deposition. Certain peculiarities of the copper-plating process (low rate, absence of evolution of $H_2$) are explained by the properties of compounds of the hydride type formed on the surface of the Cu.

**39117 (K-Trans—203) Catalytic dissociation of hypophosphites. 8. Features of the precipitation of Ni and Co from citrate solutions.** Lunyatskas, A.M.; Prokopchik, A.Yu.; Shlegyarene, E.A. Translated from *Lietuvos TSR Mokslu Akademijos Darbai, Serija B: Chemija, Technika, Fizine Geografija ;* 4: No. 63, 17-25(1970). Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01. Order Number DE83013572.

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Differences in deposition rate of Co and Ni from solutions containing $C_6H_5O_7^{3-}$ and $NH_4^+$ are explained by the unequal activity of hydrogen compounds formed on those metals during oxidation of the hypophosphite. Special features of Co and Ni deposition from solutions containing $C_6H_5O_7^{-3}$ are associated with the effect of increased $CH_5O_8^{-3}$ ion concentration on the solution of the surface. The decrease in Co deposition rate from the citrate solution with an increase in $NH_4^+$ ion concentration is associated with the formation of ammonium complexes of trivalent cobalt.

## 3602 Ceramics, Cermets, And Refractories

*REFER ALSO TO CITATION(S) 38425, 38499, 38522, 38532, 38914, 39015, 39876*

**39118 (ARL-TR—31) Erosion resistant ceramics for coal utilization.** Kazi, A.; Whiteway, S.G. (National Research Council of Canada, Halifax, Nova Scotia). 1982. 15p. (NRCC—19914). National Research Council of Canada, Halifax, Nova Scotia.

Ceramic bars were prepared from water and alcohol slurries by slip casting, and by hydrostatic pressing. The same particle-sized powder was used in each case. The cylindrical components were dried, prefired and machined to a specific shape before final sintering. The quality and texture of the surface finish was recorded. The shrinkages in different directions were measured. The densities of the final products and their resistance against abrasion were compared with recrystallized alumina samples. The compressive strength of these samples was measured. Samples prepared for this work showed promising mechanical and physical properties suitable for nozzle application. (4 refs.)

**39119 (CEA-CONF—6472) Determination of the thermal diffusivity of molten $UO_2$.** Otter, C.; Damien, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Sep 1982. 14p. (In French). (CONF-820985—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702045.

From 8. European conference on thermophysical properties - high temperatures high pressure; Baden-Baden, F.R. Germany (27 Sep 1982).

The thermal diffusivity of $UO_2$, above the melting point was measured by the flash laser technique. The $UO_2$ samples were sealed by electron beam welding in flat tungsten cells. The first results confirm the previous data of Kim et al and show a strong in-

crease (by a factor 2 or 3), in the corresponding thermal conductivity of molten $UO_2$.

**39120 (DOE/ER/01198—1400) Solidification and microstructure of laser-melted alumina.** Matthiesen, D.H. (Illinois Univ., Urbana (USA). Dept. of Ceramic Engineering). 1982. Contract AC02-76ER01198. 75p. NTIS, PC A04/MF A01. Order Number DE83013430.

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A continuous-wave, 150-watt, $CO_2$ laser was used to controllably melt the surfaces of 60% dense, dry-pressed alumina-powder compacts. Dense, thin platelets were formed upon solidification. Situations involving intensities ranging from 3200 to 40 W/cm$^2$ and local exposure times of 0.005 to 300 seconds were studied in both stationary and traversing beam situations. Depending on the lasing conditions, analyses of the solidified microstructures by SEM, optical microscopy and x-ray diffraction revealed combinations of a fine-grain chill zone or random orientation, large-grain equiaxed zone of random orientation and a columnar zone of highly preferred orientation in the [113] direction. The features are similar to those observed in solidification investigations of mold casting of metals. These microstructures are related to the depth of the melt which is in turn controlled by the beam intensity and irradiation period. These conditions have been mapped out on an intensity versus time plot to indicate regions of characteristic microstructures.

**39121 (PNL-SA—11393) Induced swelling in radiation-damaged $ZrSiO_4$.** Exarhos, G.J. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 13p. (CONF-830573—1). NTIS, PC A02/MF A01. Order Number DE83013261.

From 2. international conference on radiation effects in insulators; Albuquerque, NM, USA (30 May 1983).

Samples containing 10 wt % $^{238}$Pu incurred bulk radiation damage through internal alpha-decay processes. Undoped samples were subjected to external irradiation from 5.5-MeV alpha sources, and from a $^{60}$Co gamma source. Actinide-doped $ZrSiO_4$ exhibits dose-dependent swelling caused by displacement processes leading to ingrowth of amorphous regions. Bulk-density and XRD measurements as a function of dose showed first-order exponential ingrowth behavior similar to that observed in other actinide-doped materials. Results are compared with reported data for naturally damaged crystals subjected to significantly lower alpha-decay rates. No significant dose-rate dependence on damage ingrowth has been observed. Kinetic models for the observed dose-dependent swelling are proposed and rate constants for damage ingrowth in synthetic and natural crystals are compared. Vibrational Raman measurements indicate that the initial stage of damage ingrowth is confined to the silicate sublattice. Vibrational results are discussed in terms of microstructural changes which result from irradiation.

**39122 (SAND—83-1260C) Photoferroelectric sensitivity enhancement in PLZT by thermal diffusion of metals.** Land, C.E.; Peercy, P.S. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 7p. (CONF-830637—3). NTIS, PC A02/MF A01. Order Number DE83012628.

From IEEE international symposium on applications of ferroelectrics; Gaithersburg, MD, USA (1 Jun 1983).

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We reported in previous papers that both the near-UV and visible photosensitivites of PLZT ceramic can be greatly enhanced by ion implantation. We present new results which suggest that a combination of thermal diffusion of Al and implantation of Ne produces photosensitivity enhancement greater than that achieved with ion implantation alone.

## 3604 Polymers And Plastics

*REFER ALSO TO CITATION(S) 38512*

**39123 (BDX—613-2949) Solvent stress-cracking study for a matrix material.** Bohnert, G.W. (Bendix Corp., Kansas City, MO (USA)). Jun 1983. Contract AC04-76DP00613. 30p. NTIS, PC A03/MF A01. Order Number DE83014075.

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Solvent stress cracking tests were conducted on several alternate resins being considered for molding a matrix. Two resins showed solvent resistance equal to or better than the present material. Information useful in predicting safe and breaking stress levels for matrices exposed to solvent was generated.

**39124 (ZfK—473) Kinetics and mechanism of the formation and etching of particle tracks in polyethylene-terephthalate.** Lueck, H.B. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1982. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83701693.

The physical and chemical processes initiated by a particle passing through a polymer are reviewed. Particular attention is devoted to the processes in PETP. The influence of the material parameters and environmental effects on the subsequent reactions in PETP is discussed. Models of the mechanism and kinetics of the alkaline degradation on the surface and in the etch channel are presented. The character and the effect of the relevant species has been taken into consideration. The mechanism of the photo-oxidative sensitivity enhancement is discussed. The models mentioned above are taken as a basis to interpret the empirical response function. It is shown, that the response function can be applied to bulk-irradiated polymers as well. Treeing in electrically stressed particle tracks assisted by an etchant can be attributed to the electrostatic pressure. However, the differences in the behaviour of the structures give evidence, that the formation of craze structures and bubbles in the presence of a nonetching electrolyte is the result of the electroosmotic pressure.

## 3606 Other Materials

*REFER ALSO TO CITATION(S) 38624, 38914, 38914, 39193*

**39125 (CEA-CONF—6448) Small angle neutron scattering study of structural heterogeneities in αSi:H.** Bellissent, R.; Chenevas-Paule, A.; Roth, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1982. 4p. (CONF-820937—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702046.

From 16. international conference on the physics of semiconductors; Montpellier, France (6 Sep 1982).

Small angle neutron scattering measurements have been made on pure, hydrogenated or deuterated samples of amorphous silicon. The scattered intensity from the sputtered films indicate density fluctuations of average radius of gyration of about 125 A. The presence of a ring at 0.22 $A^{-1}$ on the diffraction pattern obtained from α-Si:H suggests a possible correlation length of about 30 A.

**39126 (DOE/ER/10936—2) Studies of the microscopic physical and chemical properties of graphite intercalation compounds. Progress report, July 1, 1982-June 30, 1983.** (Kentucky Univ., Lexington (USA). Research Foundation). 1983. Contract AS05-81ER10936. 31p. NTIS, PC A03/MF A01. Order Number DE83013733.

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Optical spectroscopic (Raman, reflectivity), low-temperature electronic transport, superconductivity, hydridation, Moessbauer spectroscopic, and structural and neutron scattering studies were conducted on graphite intercalation compounds. The superconductivity of $KHgC_8$, $KHgC_4$, $KTl_{1.5}C_4$, $KC_8$, $KC_{24}$, $RbC_8$, and $CsC_8$ was investigated in particular. 10 figures. (DLC)

**39127 (DOE/NBM—3012040) Calculations of channeling in semiconductor superlattices.** Barrett, J.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE83012040.

Simulations were carried out to assess possible sources of dechanneling of 1 to 2 MeV He ions in InAs-GaSb superlattices. Results indicate that the sources are the strain and axis tilt produced by lattice constant mismatch between the two materials. (DLC)

39128 **(HMI-B—370) Report of the working group on neutron scattering.** (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). Jan 1982. 210p. (English and German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83902388.

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Topics include neutron scattering study of the magnetic order in TMND; neutron inelastic scattering study of transverse spin fluctuations in $CsNiF_3$ (a soliton-only central peak; investigations of the mixed crystal system Dy(P/sub 1-x/VxO4); extinction effects in the mixed phase region of $DyPO_4$; elementary excitations in easy-plane Heisenberg ferromagnets; two-magnon scattering in $CsNiF_3$; observation of hyperfine-enhanced nuclear polarization in $CoF_2$ by neutron diffraction; magnetic ordering in CsMn/sub 1-x/Co/sub x/ $Cl_2.2H_2O$; neutron and x-ray studies of $CsNiFeF_6$ and $CsMnFeF_6$ single crystals; Compton profile measurements on $Mg(OH)_2$ and the electron distribution in the $OH^-$-ion; structure factors and Compton profile of beryllium; Compton scattering in copper; x-ray diffraction in $MmF_3$; rotational motion and incoherent scattering function of the $OH^-$-group in the cubic rotator phase of NaOH; dynamics of the $NH_4^+$- ion in phase I of $NH_4I$; critical phenomena in PTP; molecular conformation near the order-disorder transition in PTP; ferroelectric fluctuation in $KD_2PO_4$; neutron diffraction study of $NnSe_2$; structural investigations of polyacetylene and polyphenylene by neutron scattering; and temperature dependence of the compressibility of $d_8$-naphtalene. (WHK)

39129 (INIS-SU—145, pp 73-77) **The theory of channeling hadron radiation.** Truten, V.I.; Fomin, S.P.; Shul'ga, N.F. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

It is shown that in the range of frequencies providing the condition $l<a$, where $l=2\text{epsilon}(\text{epsilon}-h/2\pi\omega)/m^2\omega$-longitudinal dimension of radiation formation region, m and epsilonM-gthe mass and energy of the particle, $\omega$-the frequency of the irradiated photon, $\alpha$-the lattice constant, i. e. in the absence of coherence the effect of sharp increase of radiation intensity of relativistic positively charged particles moving in the crystal in axial channeling regime should take place as compared with radiation intensity of particles moving in the amorphous medium and in the crystal in the absence of channeling. The considered effect should take place for any positively changed particles. The range of frequencies in which this effect occurs rapidly increases with the growth of the particle mass. Evaluations show that the forecasted effect can be detected in a wide range of the spectrum in channeling of relativistic hadrons.

39130 (INIS-SU—145, pp 106-111) **1.2 GeV electron radiation in silicon monocrystal in the low-energy range.** Vit'ko, V.I.; Grishaev, I.A.; Kovalenko, G.D.; Shramenko, B.I. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

The method for measuring radiation spectra in the range of low energies of ultrarelativistic particles channeling in the monocrystal is suggested. Photon scattering at large angle is used in the suggested method; in this case high-energy photons cannot reach a detector. Spectral intensity of photons in the 0.1 to 40 MeV range at 1.2 GeV electron channeling in the silicon monocrystal has been investigated in the experiment. The results obtained qualitatively agree with the theory.

39131 (INIS-SU—145, pp 115-119) **Peculiarities of emission spectra of relativistic electron channeling in ordered alloy monocrystals.** Ehtingof, E.I. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

Consideration of channeling electrons in monoatomic crystals is generalized for the case of ordered alloys to clarify peculiarities of radiation spectra in the presence of atoms of different kinds able to order on lattice points of different type. It is shown that the maximal radiation frequency caused by channeling along the planes replenished by the atoms with large charges will increase in the alloy. The maximal radiation frequency caused by channeling along the planes replenished with atoms of smaller charges will, on the contrary, decrease. As a result two peaks broken at these frequencies will appear in spectral distribution of radiation intensity. One of them located in the range of high frequences is formed at the expense of contribution of only "heavy" planes. The other one located in the low frequency range will be determined by the sum of contributions of both groups of planes. With the growth of the order degree in the alloy the difference frequencies corresponding to the peaks will grow.

39132 (INIS-SU—145, pp 211-215) **Determination of the angular range of transition from axial to plane channeling.** Vedel, R.; Lenkajt, K. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

The equation of particle motion is investigated in passing from the axial channeling to the planar channeling. The transition from the axial channeling to planar is determined by the region of particle incidence angles. The boundaries of this angular region are determined for proton channeling in silicon.

39133 (INIS-SU—145, pp 230-235) **Study of the angular distributions of $H^+$ ions scattered on the binary atom chains in the KF crystal nearsurface layer containing atom shifts.** Kovaleva, E.A.; Shipatov, E.T. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

The paper deals with investigation of atomic displacement effect on the angular distributions of ions elastic-scattered at large angles on mixed K-F chains located along the <100> axes of KF crystal. Correlation of neighbouring atom displacements in transverse optical oscillations was taken into account in thermal oscillation simulation. The calculation results are presented in the form of dependence of ion yields scattered separately on the K and F atoms on the angle of particle beam incidence relatively to the chain axis. It is shown that atomic displacements in binary chains have changed angular distributions of ions scattered at large angles. The phenomenon of sharp increase of scattering yield when the "shadow" boundary fall behind the atom of one kind on the neighbouring displaced atom of another kind near the crystal surface can be used in determining the value and direction of atomic displacements under the condition of scattering effect separation for the atoms of each kind at low temperatures.

39134 (INIS-SU—145, pp 242-245) **Channeling of hydrogen atoms, generating in KCl-KH hydrogen-containing crystals under fast proton action.** Grigoruk, L.V.; Bikbaeva, Z.G. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

The paper deals with discussion of the possibility of long-path migration Hsub(i)sup(0) by channeling on the basis of experimental data on the spatial redistribution of U- and F-centres, formed by fast protons. KCl and KCl-KH crystals with the uniform initial U-center distribution over the specimen have been irradiated in vacuum by protons accelerated in a cyclotron up to 10 MeV with $10^{10}$ $cm^{-2}xs^{-1}$ flux, (3-60)x$10^{12}$ $cm^{-2}$ integral dose. Peculiarities in profiles of F- and U-centre distributions take place at low temperatures as well as at room temperatures. The revealed nonmonotony in U- and F-centre distribution in hydrated KCl-KH crystals are associated with migration of interstitial hydrogen produced under irradiation that results in accumulation of U-centres at the end of the proton path.

39135 (INIS-SU—145, pp 286-289) **Shadow effect study of Al atom location, displaced from the point of the crystal lattice.** Eremin, N.V.; Melikov, Yu.V.; Tulinov, A.F. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

The problem of determining the location of Al dispaced atoms was solved in the process of crystal irradiation by protons in the experiment on measuring the resonance life time in the direct shadow geometry. The dependence of the intensity in the minimum of the angular distribution of scattered protons in the neighbourhood of the crystallographic axis <110> and planes (100) and (111) on the radiation dose was investigated. Comparison of the experimental Ksub(ij) values with calculations permits a choice among the three possible locations of displaced atoms. Tetrahedral locations of interstitials is shown to be dominant.

39136 **(KFKI—1982-63) Structure and photoluminescence of the A-Gesub(x)Sesub(1-x) system.** Kosa Somogyi, I.; Koos, M. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Aug 1982. 32p. (CONF-8208119—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701650.

From International conference - amorphous semiconductors; Bucharest, Romania (30 Aug 1982).

Microfiche only, copy does not permit paper copy reproduction. Original copy available until stock is exhausted0 refs.; 11 figs.

A review of correlations between structural and luminescence properties of Gesub(x)Sesub(1-x) ($0<x<0.43$) glasses is given. Photoluminescence emission and excitation spectra, fatigue and decay kinetics of luminescence in these compounds are discussed. Existing data and models are compared and discrepancies between predictions of the models and experimental observations are pointed out.

39137 **(KFKI—1982-64) Crystallization and local order of bulk Assub(x)Tesub(1-x) glasses.** Faigel, Gy.; Granasy, L.; Vincze, I.; Waard, H. de. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701651.

Microfiche only, copy does not permit paper copy reproduction1 refs.; 6 figs.

The crystallization and the local order of the bulk Assub(x)Te(1-x) ($0.2<=x<=0.8$) glasses have been investigated by DSC, X-ray and Moessbauer methods. During the crystallization a metastable phase has been observed and it was identified as fcc AsTe. The local surroundings of these Assub(x)Tesub(1-x) glasses characterized by the $^{125}$Te Moessbauer measurements were compared with those of the stable monoclinic $As_2Te_3$, hexagonal Te and metastable fcc AsTe.

39138 **(KIYI—81-9) Prospect materials and new methods for formation of active elements of semiconductor detectors.** (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1981. 54p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83780698.

Selected papers were processed for inclusion in the Energy Data Base.

39139 **(SAND—83-1194C) Axial-channeling studies of strained-layer superlattices.** Picraux, S.T.; Dawson, L.R.; Osbourn, G.C.; Chu, W.K. (Sandia National Labs., Albuquerque, NM (USA); North Carolina Univ., Chapel Hill (USA)). 1983. Contract AC04-76DP00789. 19p. (CONF-830570—4). NTIS, PC A02/MF A01. Order Number DE83013309.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

Axial-channeling results are presented for the analysis of strained-layer superlattices (SLS), a broad new class of semiconductor materials with adjustable electronic properties. In/sub x/Ga/sub 1-x/As/GaAs periodic layer structures grown by molecular-beam epitaxy were analyzed by 2-MeV He-ion backscattering and channeling. Random spectra are used to obtain information on the layer thickness and composition. Channeled spectra and angular scans provide information on the lattice strain. The tetragonal distortions in the growth direction give rise to alternating tilts in inclined crystal rows at each interface. This results in significant dechanneling and narrowing of the angular scans along the [110] directions, but not along the [100] growth direction. Both the magnitude of the dechanneling with depth and the narrowing of the angular scans are directly related to the SLS lattice strain; theoretical calculations are required to determine the absolute magnitude of the strain. Results suggest the technique is sufficiently sensitive to detect lattice mismatches $\simeq 0.2\%$, corresponding to lattice distortions of 0.01 A.

39140 **(SAND—83-1279C) Anomalous piezoelectric current pulses from impact-loaded lithium niobate.** Graham, R.A.; Brown, W.T. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 7p. (CONF-830637—4). NTIS, PC A02/MF A01. Order Number DE83013311.

From IEEE international symposium on applications of ferroelectrics; Gaithersburg, MD, USA (1 Jun 1983).

The present work reports study of impact-generated piezoelectric current pulses which deviate from elastic dielectric behavior. The anomalous current pulses are similar in character to those observed in prior work on X-cut quartz but differ significantly in detail.

39141 **(ORNL-tr—4980) Glasses for the solidification of high-level radioactive waste: their behavior in the presence of water.** Grauer, R. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland); Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. C; EIR 477. 141p. NTIS, PC A07/MF A01. Order Number DE83013402.

Because of their amorphous structure, glasses are particularly suitable for the solidification of the mixture of high-level radioactive wastes resulting from reactor fuel reprocessing: they are not sensitive to variations in the compositions of waste oxides and are resistant to the damaging effects of radiation. The borosilicate glasses used for this purpose have been investigated for about 25 years, and waste vitrification techniques have been tested on a commercial scale. In view of possible accidents in a final waste repository, the chemical resistance of this type of glasses to attack by groundwaters is of special interest. The present report deals with the corrosion behaviour of glasses and discusses the most significant controlling parameters. The dissolution rates needed for safety analysis must be determined in relatively short-term experiments. Since the results can depend strongly on the type of test procedures used, a critical assessment of these techniques is necessary. Experimental results are illustrated by means of selected examples. Particular emphasis is placed upon the effects of increased temperatures and of nuclear radiation. The models which have been proposed for the estimation of the long-term behavior of vitrified waste are not yet fully complete and require improvement. Furthermore, the actual dissolution rates which are used in such models should be revised: to be desired are values which take into account the actual environmental conditions at the storage site. It should be noted, however, that even with current conservative input data on corrosion rates, a lifetime on the order of $10^5$ years can be expected for the glass blocks to be deposited. The report concludes with recommendations fo further investigations.

39142 **Strength of G-10CR and G-11CR epoxies after irradiation at 5 K by gamma rays.** Coltman, R.R. Jr.; Klabunde, C.E. (Oak Ridge National Lab., TN (USA). Solid State Div.). *Journal of Nuclear Materials;* **113**: No. 2/3, 268-272(Jan 1983).

Published in summary form only; Letter-to-the-editor.

39143 **Impurity diffusion in amorphous silicon and its implications for solar cells.** Kalbitzer, S.; Reinelt, M.; Stulz, W. (Max-Planck-Institut fur Kernphysik, Heidelberg, F.R. Germany). pp 1059-1062 of Fourth e.c. photovoltaic solar energy conference. Bloss, W.H., Grassi, G. (eds.). Dordrecht, Netherlands; D. Reidel Publishing Company (1982). (CONF-820555—).

From 4. photovoltaic solar energy conference; Stresa, Italy (10 May 1982).

Diffusion coefficients of a variety of impurities from different columns of the atomic table have been measured by high resolution nuclear spectroscopy. The relevance of the resulting distribution lengths with respect to solar cell properties is discussed for short time deposition processes at elevated temperatures and long time operation at ambient temperatures.

# 40 CHEMISTRY

39144 **(BARC—1151) Chemical application of positron annihilation through triple coincidence measurement.** Yegnasubramanian, S.; Gangadharan, S. (Bhabha Atomic Research Centre, Bombay (India)). 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701644.

Paper copy only, copy does not permit microfiche production0 refs., 10 figures.

This report summarises the work on the application of triple coincidence measurement of annihilation radiation for providing chemical state information; the observations have been corroborated by angular correlation and Doppler broadening measurements and supplemented by the magnetic quenching in the angular correlation and peak-to-valley ratio in the Ge(Li) singles spectrum for the 511 keV line.

## 4001 Analytical And Separations Chemistry

*REFER ALSO TO CITATION(S) 38344, 38344, 38387, 38430, 38488, 38489, 38490, 38545, 38619, 38620, 39161, 39218, 39734*

39145 **(AD-A—125003/4) Instrumental photon activation analysis using the linear accelerator at the Naval Postgraduate School. Master's thesis.** Fisher, W.A. (Naval Postgraduate School, Monterey, CA (USA)). Oct 1982. 108p. NTIS, PC A06/MF A01.

Charcoal, charcoal residue, potting soil, aluminum foil, bismuth germanate, and petroleum samples have been investigated using instrumental photon activation analysis (i.e., no radiochemistry). The major and minor elements routinely observed by this nondestructive method were: C, Cl, Ca, Fe, Mg, Si, and K. A compreshensive review of the principles of IPAA was also included in the study. The principles were applied to a theroetical analysis of an oil sample in which the trace element concentrations were known. It was concluded that IPAA is a highly sensitive technique which could be used to fingerprint oils.

39146 **(AERE-R—10470) Determination of rare earth elements in geological materials by neutron activation analysis using a group separation and high resolution gamma-ray spectrometry.** Sanders, T.W.; Wright, S.J. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Sep 1982. 23p. Available from H.M. Stationery Office, price Pound2.00.

A procedure is described whereby ten rare earth elements were determined in geological materials sing a combination of instrumental and radiochemical neutron activation analysis. An approach is recommended in which rare earths are radiochemically separated as a group and the radiochemical yields calculated by comparing the activity of samarium determined non-destructively with that obtained after separation. This procedure enables results to be obtained rapidly for a range of rare earths using only readily available reagents and apparatus.

39147 **(CONF-830565—4) Scintillation counting: an extrapolation into the future.** Ross, H.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01. Order Number DE83012654.

From Advances in scintillator counting conference; Banff, Alberta, Canada (15 May 1983).

Progress in scintillation counting is intimately related to advances in a variety of other disciplines such as photochemistry, photophysics, and instrumentation. And while there is steady progress in the understanding of luminescent phenomena, there is a virtual explosion in the application of semiconductor technology to detectors, counting systems, and data processing. The exponential growth of this technology has had, and will continue to have, a profound effect on the art of scintillation spectroscopy. This paper will review key events in technology that have had an impact on the development of scintillation science (solid and liquid) and will attempt to extrapolate future directions based on existing and projected capability in associated fields. Along the way there have been occasional pitfalls and several false starts; these too will be discussed as a reminder that if you want the future to be different than the past, study the past.

39148 **(HEDL-SA—2871-FP) Communicating with analytical chemists about quality assurance.** Delvin, W.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 6 Apr 1983. Contract AC06-76FF02170. 13p. (CONF-830475—4). NTIS, PC A02/MF A01. Order Number DE83012156.

From American Society for Quality Control conference; Richland, WA, USA (17 Apr 1983).

Analytical chemists are beginning to recognize the desirability of applying quality assurance principles to laboratory operations. They generally do not understand the concepts of quality assurance and they tend to misuse the term quality assurance. On the other hand, analytical chemists have been concerned about the quality of their measurement data for a long time. Over the years they have established effective practices to control laboratory operations to avoid losses and failures. The problem has been to communicate with analytical chemists in a way that will give them an adequate understanding of what quality assurance is all about and how to apply it to their laboratory operations; and, at the same time, give credit for the many good control practices already in use. This paper discusses the subject and presents an approach currently being developed to improve analytical chemists' knowledge and use of quality assurance.

39149 (INDC(CCP)—177/L, pp 53-58) **Study of the influence of scattering effects on the shape of the fission neutron spectrum.** Blinov, M.V.; Vitenko, V.A.; Dushin, V.N.; Yurevich, V.I. (Radievyj Inst., Leningrad (USSR)). May 1982. NTIS (US Sales Only), PC A04/MF A01.

Translated from Russian.

In Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).

Precision neutron spectrometry is based essentially on the time-of-flight technique, since it gives one a high energy resolution. However, fission spectrum measurements by this technique show a substantially greater spread of experimental data than might be expected from the errors cited by the authors, especially in the low-energy region. The discounting of effects such as neutron scattering in particle detectors, on structural parts and in the environment, can lead to a noticeable distortion of the neutron spectrum and is possibly the major reason for the discrepancy observed in the experimental results. For the study and consideration of these neutron scattering effects both experimental and theoretical methods can be applied usefully, since they supplement each other and increase the reliability of the results. In our study we have used for the first time a calculation algorithm which takes into account the process of multiple scattering in time. This is a much more complex problem than calculations not involving time. Mathematically we are solving the inverse problem of the theory of radiation transfer, i.e. on the basis of a known experimental spectrum we reconstruct the energy spectrum of the neutron source.

39150 **(IPEN-Pub—42) Non destructive mass analysis of natural uranium by the pulsed source technique.** Coelho, P.R.P.; Holland, L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil). Centro de Engenharia Nuclear). Jul 1982. 17p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702037.

Results of nondestructive mass analysis of natural uranium by the pulsed source technique, are presented. Fissions are produced by irradiating the test sample with pulses of 14 MeV neutrons and the uranium mass is calculated on a relative scale from the measured emission of delayed neutrons. Individual measurements were normalized against the integral counts of a scintillation detector measuring the 14 MeV source neutron output. Delayed neutrons were measured using a specially constructed slab detector operated in antisynchronism with the fast pulsed neutron source. The 14 MeV neutrons were produced via the T(d,n)$^4$He reaction using a PN-400 Van de Graaff accelarator operated at 200 kV in the pulsed source mode. Three types of sample were analyzed, namely: discs of metalic uranium, pellets of sintered uranium oxide and plates of uranium aluminium alloy sandwiched between aluminium. These plates simulated those of Material Testing Reactor fuel elements. Results of measurements were reproducible to within an overall error of 1.6 to 3.9%; the error of a specific measurement depending on the shape, size and mass of the sample.

39151 **(JINR—14-81-841) Backscattering analysis of Nb+Sn films.** Vavra, I.; Skrypnik, A.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1981. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701907.

The parameters of energy losses [S] of $^3He^+$ and $^4He^+$ particles backscattered on Nb and Sn are obtained. It is shown that on the basis of the obtained values of [S] it is possible to analyse the composition of Nb+Sn films Up to their thickness approximately 1.3 μm.

39152 **(K/PS—496) Electroplating system for radiochemical analysis.** Jones, H.C.; Sulfridge, C.; Brown, T.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Jun 1983. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE83014173.

An electroplating system was designed and fabricated for radiochemical analysis. The system consists of four plating units using commercially available power supplies and stirring motors. Reliability and ease of maintenance were primary objectives in this design. Satisfactory reliability was obtained by careful selection of components and the use of liberal safety factors in circuit design. Ease of maintenance has been effected by modular arrangement of the four units.

39153 **(LYCEN—81101) Use of nuclear method analysis in ultrahigh vacuum. Application to the hydrogen dosage in solids.** Chartoire, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire; Lyon-1 Univ., 69 (France)). 1982. 71p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83702039.

Thesis.

It is possible to determine hydrogen by the $^1H(^{15}N,\alpha\gamma)^{12}C$ nuclear reaction, in an ultra-high vacuum and with sample temperature monitoring, without reducing the detection efficiency of the γ rays emitted. This method is sensitive on the surface of the samples as well as in the core. Further, its resolution in depth on the surface is less than 50 x $10^{-4}$ μm for elements with an atomic number above that of silicon. This surface analysis technique competes with and supplements the performance of the Auger and ESCA spectrometries. The cooling or heating of the samples in-situ from -150°C to +450°C enables an initial approach to be made to the phenomena of adsorption of the hydrogenated species on the surface of the samples. The possibility of plotting concentration profiles to depths of around a micrometer, also provides a means for studying the sorption of hydrogen in solids. The importance is brought to light of the quality of the residual vacuum and mainly of the partial steam pressure in the curves showing the change in the concentration of surface contamination hydrogen according to the quantity of incident ions. At temperatures above 300°C, the radiolysis and desorption phenomena of the species thus created become very significant. These were obtained only by making a study in greater depth of the validity conditions of the model used for describing the effusion of hydrogen under the analytical beam.

39154 **(ORNL/TM—8656) Formaldehyde surface-emission monitor. Protocol I: pressed-wood products.** Matthews, T.G.; Daffron, C.R.; Corey, M.D. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01. Order Number DE83013731.

The formaldehyde surface emission monitor (FSEM) has been developed for passive non-destructive measurement of formaldehyde ($CH_2O$) emission rates from $CH_2O$ resin-containing materials. It is envisaged as a potential quality control and in-situ monitoring technique. For quality control applications to pressed-wood products, strong correlations between the results of the FSEM and environmentally controlled (small scale) chamber tests were observed. The FSEM is used to measure the cumulative $CH_2O$ emission from a finite area of pressed-wood product during a fixed test period. The final result is reported as an average $CH_2O$ emission rate (mg $CH_2O/m^2h$).

39155 **(UCRL—89256) Applications of simultaneous ion backscattering and ion-induced x-ray emission.** Musket, R.G. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 16p. (CONF-830570—5). NTIS, PC A02/MF A01. Order Number DE83013045.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

Simultaneous ion backscattering and ion-induced x-ray emission (E/sub x/≧ 300 eV) analyses have been performed using helium ions as probes of the first few hundred nanometers of various materials. These studies serve as a demonstration of the complementary nature of the two types of information obtained. Uncertainties associated with each of the individual techniques were reduced by performing both analyses. The principal advantages of simultaneous analyses over sequential analyses have been delineated.

39156 **Measurement of iodine-129 at the femtogram level by negative surface ionization mass spectrometry.** Stoffels, J.J. (Pacific Northwest Lab., Richland, WA (USA)). *Radiochemical and Radioanalytical Letters;* **55**: No. 2, 99-105(23 Dec 1982).

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A mass spectrometer method is being developed for measurement of environmental iodine-129. Negative surface ionization of iodine on a lanthanum hexaboride-coated rhenium filament is used to produce $I^-$ ions with high efficiency. A three-stage mass spectrometer provides high abundance sensitivity for measurement of the large $^{127}I/^{129}I$ isotope ratios encountered in environmental samples. The ability to measure $10^7$ atoms ($2x10^{-15}$ g) of iodine-129 in a pure sample of sodium iodide which has a $^{127}I/^{129}I$ isotope ratio of $0.5x10^8$ has been demonstrated.

39157 **Selective laser photoionization for mass spectrometry.** Miller, C.M.; Nogar, N.S.; Gancarz, A.J.; Shields, W.R. (Los Alamos National Lab., NM). *Analytical Chemistry;* **54**: No. 13, 2377-2378(1982).

The measurement of ratios of isotopes of a single element is often complicated by isobaric interferences resulting from incomplete chemical separations. Selective laser photoionization of the element of interest has the potential to reduce or eliminate the isobaric interference while at the same time accurately reflecting the isotopic distribution of the element of interest. In this paper, the selective ionization of Lu in the presence of Yb is demonstrated. The resonance-enhanced two-photon ionization process was found to be extremely selective. (SC)

## 4002 Inorganic And Physical Chemistry

*REFER ALSO TO CITATION(S) 39182, 39183, 39189*

39158 **(DOE/ER/14953—T2) Kinetics of the reaction of chlorine atoms with vinylbromide and its use for measuring chlorine atom concentrations.** Park, J.Y.; Slagle, I.R.; Gutman, D. (Illinois Inst. of Tech., Chicago (USA). Dept. of Chemistry). 1982. Contract AC02-78ER14953. 29p. NTIS, PC A03/MF A01. Order Number DE83006325.

The reaction of chlorine atoms with vinylbromide, $Cl+C_2H_3Br...>C_2H_3Cl+Br$, has been tested as a titration reaction for chlorine atoms in gas-phase fast-flow reactors using both continuous and pulsed atom sources. The vinylchloride produced by this reaction was determined using photoionization mass spectrometry and was found to be an accurate measure of the in situ chlorine-atom concentration down to $5x10^{10}$ atoms $cm^{-3}$. The reaction is rapid, stoichiometric, and involves the use of easily handled substances. It is particularly well suited for use with photoionization mass spectrometer detectors because of the low ionization potentials and high photoionization cross sections of both vinylbromide and vinylchloride. The rate constant of this reaction was measured at 298 K and determined to be $1.43(+/-0.29)x10^{10}$ $cm^3$ $molecule^{-1}$ $sec^{-1}$.

**39159 (DOE/ER/14953—T3) Extent of the displacement route in the reactions of fluorine atoms with ethylene, vinylchloride, and vinylbromide.** Slagle, I.R.; Gutman, D. (Illinois Inst. of Tech., Chicago (USA). Dept. of Chemistry). 1982. Contract AC02-78ER14953. 19p. NTIS, PC A02/MF A01. Order Number DE83006324.

The chemical branching of three fluorine-atom reactions, those with $C_2H_4$, $C_2H_3Cl$, and $C_2H_3Br$, was studied in real-time experiments using a tubular reactor coupled to a photoionization mass spectrometer. The fluorine atoms were generated by the $CO_2$-laser induced secondary photolysis of $C_6F_5Cl$ which also appears to produce tetrafluorobenzyne (c-$C_6F_4$). The measured fractional extents that the three reactions studied proceed by a displacement route at 295 K (to yield $C_2H_3F+X$) are 0.65 (+/-0.06), 0.72 (+/-0.14), and 0.72 (+/-0.14) for $C_2H_4$, $C_2H_3Cl$, and $C_2H_3Br$ respectively.

**39160 (IAEA-R—1446-F) Structural and lattice dynamics studies of microcrystals by means of the Moessbauer effect spectroscopy. Final report for the period 15 November 1973 - 14 November 1977.** Pasternak, M. (International Atomic Energy Agency, Vienna (Austria)). May 1978. 3p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701647.

Moessbauer studies on $^{129}I$, $^{57}Fe$ and $^{119}Sn$ were conducted in several disordered and microscopic systems in order to investigate properties of lattice dynamics, chemical bonding and phase transitions. The project included the following studies: (1) Granular crystals of Sn embedded in tin-oxide matrix; the nature of the superconductivity transition of very small grains of tin was investigated. (2) Lattice dynamics and characterization of amorphous tin oxide obtained by condensing atoms of Sn and $O_2$ gas on a 77 K substrate. The hyperfine interaction and the temperature dependence of the Debye-Waller factor were essential to determine the structure of the amorphous tin oxide. (3) The nature of the chemical bond of the alkaly halides ionic crystals and molecules; molecules of Li, Na, K, Rb and Cs iodides were trapped in agron matrices, and the isomer-shift values were obtained from absorption spectra. (4) Binding of single iron and tin atoms to $CH_4$, $NH_3$, $H_2$ and $C_6H_6$ molecules, with samples at low temperatures between 2 and 77 K; conclusions were derived regarding the cryochemistry of these systems, as related to fundamental problems of catalysis, chemisorption and "cracking" of organic molecules.

**39161 (IPEN-Pub—45) Study of the separation of $^{233}Th$ from the radioisotopes by the resin saturated with thorium.** Sepulveda Munita, C.J.A.; Atalla, L.T. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil). Centro de Operacao e Utilizacao do Reator de Pesquisas). Aug 1982. 14p. (In Portuguese). (CONF-8110260—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702038.

From 32. Brazilian congress of chemistry; Belo Horizonte, Brazil (11 Oct 1981).

A separation of $^{233}Th$ from the radioisotopes formed by the irradiation of Mn, U, Ba, Cs, Co and the lanthanide elements with thermal neutrons is done. The radioisotopes formed may interfere in the neutron activation analysis of Th, when the activity of $^{233}Th$ is used. The experiments were performed with the resin Bio-Rad AG 50W X-4 (100 - 200 mesh) in the thorium form. The separation of $^{233}Th$ from the interfering radioisotopes is based on the retention of $^{233}Th$ by the resin (isotopic exchange) and the elution of the interfering radioisotopes by a dilute solution of Th in HCl 0.5M. Batch experiments were made in order to determine the equilibrium time for the isotopic ion exchange of thorium and also to determine the distribution ratio of the interfering elements between the solution and the resin. Experiments were made in column with the aim of obtaining a minimum retention of these radioisotopes in the resin.

**39162 (SERI/CP—233-1723, pp 44-46) Interactions of radicals and dyes with metallic colloids.** Lee, P.C.; Matheson, M.S.; Meisel, D. 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

**39163 (SERI/CP—233/1723, pp 64-67) Formalisms for aqueous electron transfer reactions and applications based on Ab initio molecular quantum mechanics.** Newton, M.D. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39164 (SERI/CP—233/1723, pp 71) Factors affecting excited state reactivity of $Ru(bpy)_3^{2+}$.** Meyer, T.J. 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39165 (SERI/CP—233/1723, pp 77-80) Energy transformation in transition metal complexes.** Watts, R.J. (Univ. of California, Santa Barbara). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39166 (SERI/CP—233/1723, pp 81-83) Investigation of chemical properties and reactions of mono- and dinuclear ferrocene derivatives.** Hillman, M. 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39167 (SERI/CP—233/1723, pp 122) Improved water-water interaction potentials.** Kestner, N.R. (Louisiana State Univ., Baton Rouge). 1982. NTIS, PC A08/MF A01. Contract AS05-77ER05399.

In Sixth DOE solar photochemistry research conference.

**39168 (SERI/CP—233/1723, pp 125) Electroactive metalloporphyrin films.** Macor, K.; Spiro, T.G. (Princeton Univ., NJ). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39169 (SERI/CP—233/1723, pp 128) d-$\pi$ bonding in the solid state: spin delocalization in Co(II)tetraphenylporphin.** Hanson, L.K. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39170 X-ray absorption edge and EXAFS spectroscopic studies of molybdenum ions in aqueous solution.** Cramer, S.P. (Exxon Research and Engineering Co., Linden, NJ); Eidem, P.K.; Paffett, M.T.; Winkler, J.R.; Dori, Z.; Gray, H.B. *Journal of the American Chemical Society;* **105**: No. 4, 799-802(23 Feb 1983).

X-ray absorption edge and extended x-ray absorption fine structures (EXAFS) spectra have been measured for acidic-aqueous solutions containing Mo(II), Mo(III), Mo(IV), and Mo(V). The edges increase in energy according to Mo(II) << Mo(III) < Mo(IV) < Mo(V). Bond distances calculated for the binuclear species are as follows: Mo(II)/1 M $CF_3SO_3H$ (aqueous), Mo-Mo = 2.12 A; Mo-O($OH_2$) = 2.14 A; Mo(III)/3 M $CH_3SO_3H$ (aqueous), Mo-Mo = 2.54 A; Mo-O (bridging OH) = 2.06 A; Mo-O($OH_2$) = 2.20 A; Mo(V)/3 M HCl (aqueous) ($Mo_2O_4^{2+}$ core), Mo-Mo = 2.56 A; Mo-O (terminal oxo) = 1.68 A; Mo-O (bridging oxo) = 1.93 A. The EXAFS data for Mo(IV) in 4 M methanesulfonic acid are consistent with the accepted $Mo_2O_4^{4+}$ (aq) (Mo-Mo = 2.49 A; Mo-O($\mu_2$) = 1.88 A) formulation for the red ion. Estimates of the Mo-Mo Debye-Waller factors were obtained by comparison with $\sigma$ = 0.0377 A calculated for $Mo_2^{4+}$ (aq). The stiffest Mo-Mo bond is in

$Mo_3O_4^{4+}$ (aq) ($\sigma$ = 0.031 A); $\sigma$ values for $Mo_2(\mu\text{-}OH)_2^{4+}$ and $Mo_2O_4^{2+}$ (aq) are 0.044 and 0.037 A, respectively.

**39171 Cluster synthesis. 2. The role of heteroatoms in the formation of high nuclearity transition-metal carbonyl cluster compounds. The condensation of small clusters.** Adams, R.D.; Dawoodi, Z.; Foust, D.F.; Segmueller, B.E. (Yale Univ., New Haven, CT). *Journal of the American Chemical Society;* **105**: No. 4, 831-838(23 Feb 1983). Contract AC02-78ER04900.

The compounds $HOs_3(\mu_3\text{-}S)(\mu\text{-}HC$ double bond $NR)(CO)_9$, Ia, R = $C_6H_5$, and Ia', R = $C_6H_4$-p-F, lose CO and/or $H_2$ when heated to form the hexanuclear osmium complexes $Os_6(\mu_4\text{-}S)(\mu\text{-}HC$ double bond $NR)_2(CO)_{15}$, IIa, R = $C_6H_5$, and IIa', R = $C_6H_4$-p-F, $H_2Os_6(\mu_4\text{-}S)(\mu_3\text{-}S)(\mu\text{-}HC$ double bond $NR)_2(CO)_{17}$, IIIa,b, R = $C_6H_5$, and IIIa',b', R = $C_6H_4$-p-F, which exist as two isomers, $H_2Os_6(\mu_4\text{-}S)(\mu_3\text{-}S)(\mu\text{-}HC$ double bond $NR)_2(CO)_{16}$, IVa-c, R = $C_6H_5$, and IVa'-c', R = $C_6H_4$-p-F, which exist as three isomers, and $Os_6(\mu_4\text{-}S)_2(\mu\text{-}HC$ double bond $NR)_2(CO)_{15}$, Va, R = $C_6H_5$, and Va', R = $C_6H_4$-p-F. All compounds have been analyzed by ir and $_1$H NMR spectroscopy. Compounds IIIa', IVa and Va have also been characterized by single-crystal x-ray diffraction analyses. Compounds III can be converted to IV, and IV into V. III, IV, and V are believed to be part of a sequence of cluster growth processes in which the sulfido ligands mediate the initial linking of the clusters and the subsequent formation of metal-metal bonds between them. IIIa' contains two open triangular groups of three metal atoms linked by a tetrahedrally coordinated sulfido ligand. In IVa the six metal atoms are arranged in groups of four and two, with the two groups linked by a tetrahedrally coordinated sulfido ligand. In Va the six metal atoms have condensed into a central cluster of four which has the form of a butterfly tetrahedron with sulfido ligands bridging the two open triangular faces. The two remaining metal atoms are bonded to the hinge metal atoms of the central cluster, one to each.

**39172 Stable tungsten-iridium binuclear acyl hydride and carbene hydride complexes.** Breen, M.J. (Pennsylvania State Univ., University Park); Geoffroy, G.L.; Rheingold, A.L.; Fultz, W.C. *Journal of the American Chemical Society;* **105**: No. 4, 1069-1070(23 Feb 1983).

The preparation of the very stable complex $WIrH(\mu\text{-}PPh_2)_2(CO)_5(PPh_3)$ is described with reactions included. The complex was characterized spectroscopically and by single-crystal x-ray diffraction studies. Reactions of the complex yielded binuclear acyl hydride and carbene hydride complexes which are the first reported examples of heterobimetallic compounds. (BLM)

**39173 Use of core binding energies in the assignment of the ultraviolet photoelectron spectra of the manganese pentacarbonyl halides.** Jolly, W.L. (Univ. of California, Berkeley). *Journal of Physical Chemistry;* **87**: No. 1, 26-27(6 Jan 1983). Contract AC03-76SF00098.

By using core binding energy data to correct for the effects of potential (atomic charges) and relaxation energy, one can largely resolve the ambiguities in the assignment of the first four bands in the ultraviolet photoelectron spectra of the manganese pentacarbonyl halides.

**39174 Nonradiative relaxation and quantum beats in the radiative decay dynamics of large molecules.** Rhodes, W. (Florida State Univ., Tallahassee, FL). *Journal of Physical Chemistry;* **87**: No. 1, 30-40(6 Jan 1983). Contract AS05-78EV05784.

The theory of photon emission is discussed for the case in which a molecule is excited by a coherent light pulse of frequency width Δ omega corresponding to a few wavenumbers, or less, and bracketing a number of excited molecular eigenstates. Features of the theory which are considered include: (1) conditions whereby the time evolution of a frequency-resolved emission spectrum may be measured; (2) the nature of quantum beats and the importance of distinguishing quantum beats and oscillations due to quantum mechanical memory effects; (3) the importance of molecular emission channels and their doorway states for radiative decay as a practical (as well as conceptual) basis for understanding excited state dynamics; and (4) the effects of adiabatic modulation of the spectrally active modes of a molecule by the background modes of the molecule and its medium. The role of adiabatic modulation is the most important and far-reaching aspect of the present theory. We consider, in particular, the stochastic modulation (SM) limit of adiabatic modulation which is defined under certain conditions of fast modulation by weak coupling to many background modes. In addition to its effects on kinetic stabilization of quantum transitions and on the tuning of kinetic pathways of molecular processes, SM can erase the undesirable oscillations in photon emission, thereby permitting the emergence of quantum beats in the absence of frequency-resolvable spectral structure.

**39175 (UCRL-Trans—11836) State analysis of water of crystallization.** Sugitani, Y. Translated from *Bunseki ;* No. 7, 427-435(1979). Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE83010636.

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Water contained in solids is defined as adsorbed water or, simply, as water content, which is measured by determining the weight loss after drying of a sample by heating at around 100°C; water discharged by ignition at a temperature above 100°C is quantitatively analyzed as compounded water or water of crystallization. However, water contained in solids cannot be explained in this simple manner. Water is actually present in various states. This report explains how the statuses of water can be clearly characterized and classified, and how they can be studied by various means of instrumental analysis, referring to the actual examples.

## 4003 Organic Chemistry

*REFER ALSO TO CITATION(S) 38369, 38443, 38452, 38675, 39158, 39159, 39162, 39168, 39171, 39172, 39216, 39227*

**39176 (SERI/CP—233/1723, pp 118) Studies of radical-radical interactions in photosynthetic and model photosynthetic systems.** Thurnauer, M.C.; Meisel, D.; Rutherford, A.W.; Norris, J.R. 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39177 (SERI/CP—233-1723, pp 131) Formation of J-aggregates in spread monolayers at the air-water interface. Effects of co-aggregates and varying organization on fluorescence behavior.** Patterson, L.K.; Moebius, D. (Univ. of Notre Dame, IN). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

**39178 (RFP-ABST—06) Process for synthesis of phosphonic acids and phosphinic acids.** Block, H.D.; Kohnen, H. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Jun 1983. Contract AC04-76DP03533. Translation of West German Patent 2,745,982 (1979). 6p. NTIS, PC A02/MF A01. Order Number DE83013879.

A process is claimed for the synthesis of phosphonic and phosphinic acids by hydrolysis of the corresponding esters. The phosphonic and phosphinic acids produced act as catalysts in the process, which is characterized by the fact that the hydrolysis proceeds under high pressure and that the reaction mixture contains at least twice as many moles of water as the number of moles of acid hydroxyl groups to be formed and/or present. The reaction proceeds under autogenous pressure and at temperatures between 105 and 235°C. At the end of saponification, the aqueous solutions of phosphonic and phosphinic acids can be used as is, or the acids can be purified by recrystallization, etc. and converted to salts with suitable bases. The yields are practically quantitative. The products can be used as corrosion inhibitors and sequestering agents, and represent valuable intermediate products for synthesis of other corrosion inhibitors, sequestering agents, flame retarders, textile auxiliaries and antistatic compounds.

**39179 Structure sensitivity in oxide catalysis.** Kung, H.H. (Northwestern Univ., Evanston, IL). *American Chemical Society, Division of Petroleum Chemistry, Preprints;* **28**: No. 3, 545-550(Mar 1983). (CONF-830303—).

From 185. American Chemical Society national meeting; Seattle, WA, USA (20 Mar 1983).

In this paper it is shown that similar to metal catalysis, metal oxide catalysis can be dependent upon crystalline structure. Two types of structure sensitivity are demonstrated. In one, activity and sensitivity depend upon crystalline size. In the other, they depend on the crystal plane. Comparison of the activity and selectivity of $\alpha$-$Fe_2O_3$ with that of $\gamma$-$Fe_2O_3$ in the catalysis of the dehydrogenation of 1-butene to butadiene reveals that the latter is three times more active than the $\alpha$-form and that crystalline size and possibly surface structure determine catalytic activity. The ZnO catalysis of methanol conversion to methane, CO and $CO_2$ was studied using $D_3COD$ and $CH_3OD$. Catalytic activity and selectivity is solely a function of surface structure. Of the four ZnO surfaces studied using a temperature-dependent programmed desorption technique (single crystal), (flat, non polar-10bar10, stepped-50bar51 and 40bar41, and the Zn polar surfaces-0001), the stepped 40bar41 surface (4 ZnO units/terrace) was the most active.

**39180 Singlet cyclobutyne: a relative minimum on the $C_4H_4$ potential energy hypersurface.** Fitzgerald, G.; Saxe, P.; Schaefer, H.F. III. (Univ. of California, Berkeley). *Journal of the American Chemical Society;* **105**: No. 4, 690-695(23 Feb 1983). Contract AC03-76SF00098.

The lowest singlet and triplet electronic states of cyclobutyne have been investigated by using the nonempirical molecular electronic structure theory. Initially, singlet cyclobutyne was studied with use of two-configuration self-consistent-field (TCSCF) methods and triplet cyclobutyne with single-configuration SCF theory. Three standard basis sets, of double-$\xi$ (DZ) through double-$\xi$ plus polarization (DZ + P) caliber, were employed, the largest being designated C(9s5p1d/4s2p1d), H(4s1p/2s1p). Geometrical structures and harmonic vibrational frequencies were determined with use of analytic gradient techniques. From purely geometrical considerations, the short carbon-carbon bond in singlet cyclobutyne may be labeled a weak (or long) triple bond, with r/sub e/(C double bond C) = 1.258 A. For triplet cyclobutyne a much longer carbon-carbon distance (1.323 A) is predicted, consistent with the sort of C double bond C double bond expected for this diradical species. The triple-bond CC harmonic stretching frequency for singlet cyclobutyne is predicted to be 1911 $cm^{-1}$, while the analoguous stretching frequency for the triplet diradical species is 1779 $cm^{-1}$. Vibrational analyses demonstrate that (at the levels of theory considered) both singlet and triplet cyclobutyne are relative minima on the $C_4H_4$ potential-energy hypersurface. For the former, the lowest frequency predicted at the DZ+d TCSCF level of theory is 276 $cm^{-1}$, corresponding to the ring-puckering mode. These remarks notwithstanding, it is to be emphasized that singlet cyclobutyne is a highly energetic species, predicted to lie ~ 78 kcal above vinyl acetylene, HC double bond C - CH double bond $CH_2$, the absolute minimum among $C_4H_4$ molecules. Finally, singlet cyclobutyne is predicted to lie 13 kcal below its triplet diradical.

**39181 $^{13}C$ and $^{1}H$ NMR analysis of isotopically labeled benzo[a]pyrenes.** Unkefer, C.J. (Los Alamos National Lab., NM); London, R.E.; Whaley, T.W.; Daub, G.H. *Journal of the American Chemical Society;* **105**: No. 4, 733-735(23 Feb 1983).

$^{13}C$ and $^{1}H$ NMR spectra of each of the 12 isotopomers of benzo[a]pyrene specifically labeled with carbon-13 at a methine position have been obtained. These studies lead to reassignment of 11 of the 20 $^{13}C$ resonances of benzo[a]pyrene, and to unambiguous $^{1}H$ assignments. $^{1}J$/sub cc/ values were found to follow Hansen's rule, although the specific parametrization varied significantly depending on the source of the bond-length data. The optimum fit for the methine carbons was determined to be $^{1}J$/sub cc/ = -143l + 257; for coupling between methine and quaternary carbons, $^{1}J$/sub cc/ = -119l + 227. Vicinal couplings between $^{13}C$ atoms do not show a significant correlation with the bond order of the central bond in the vicinal coupling pathway; however, coupling between vicinal carbons which are trans along the periphery of the ring system (class I) have a mean of 5.45 Hz, compared with the vicinal trans coupling through the ring (class II) with a mean of 3.06 Hz.

**39182 Structural determination of NiC/sub n/H/sub 2n/+ ions in the gas phase using Fourier transform mass spectrometry collision-induced dissociation.** Jacobson, D.B.; Freiser, B.S. (Purdue Univ., West Lafayette, IN). *Journal of the American Chemical Society;* **105**: No. 4, 736-742(23 Feb 1983). Contract AC02-80ER10689.

In this paper, Fourier transform mass spectrometry is applied to study the structures of NiC/sub n/H/sub 2n/+ complexes generated from reactions of Ni+ with a variety of hydrocarbons and demonstrate that different isomeric structures can readily be distinguished both by a collision-induced dissociation and by specific ion-molecule reactions. Evidence is provided for four unique structures of $NiC_4H_8$+ generated from reactions of Ni+ with butane, hexane, 2,2-dimethylpropane, and cyclopentanone. Dehydrogenation reactions of Ni+ with n-alkanes yield bis(olefin) complexes that are distinguishable from their isomeric monoalkene complexes. Ni+ is found to be highly selective for cleaving internal bonds and highly selective against insertion into terminal C-C bonds. Dehydrogenation becomes more competitive with alkane elimination when $\beta$-hydride transfers from secondary carbons are involved instead of from primary carbons.

**39183 Mechanisms of $Re_2(CO)_{10}$ substitution reactions: crossover experiments with $^{185}Re_2(CO)_{10}$ and $^{187}Re_2(CO)_{10}$.** Stolzenberg, A.M.; Muetterties, E.L. (Univ. of California, Berkeley). *Journal of the American Chemical Society;* **105**: No. 4, 822-827(23 Feb 1983). Contract AC03-76SF00098.

$^{185}Re_2(CO)_{10}$ and $^{187}Re_2(CO)_{10}$ were prepared separately and then utilized in combination in crossover experiments to probe for fragmentation to mononuclear rhenium species in thermal and photochemically initiated substitution reactions. For the CO-$Re_2(CO)_{10}$ exchange reaction, a reaction separately analyzed for $^{13}CO$-$^{12}CO$ interchange, no crossover was observed at 150°C after 14 half-lives of reaction (14 h). Similarly, the thermal reaction sequences of $Re_2(CO)_{10}$ + $P(C_6H_5)_3$ reversible $Re_2(CO)_9P(C_6H_5)_3$ + CO and $Re_2(CO)_9P(C_6H_5)_3$ + $P(C_6H_5)_3$ reversible $Re_2(CO)_8[P(C_6H_5)_3]_2$ + CO were examined at 150°C (maintaining a CO pressure of ~ 560 to 640 mm). No crossover was detectable in either $Re_2(CO)_{10}$ or $Re_2(CO)_9P(C_6H_5)_3$ (relative to blank experiments). Hence, phosphine substitution reactions proceed without a detectable formation of mononuclear rhenium species. These observations support a CO dissociative mechanism. A model based upon this mechanism can accurately reproduce the mass spectra observed during $^{13}CO$-$^{12}CO$ interchange. In the absence of a CO atmosphere, $^{185}Re_2(CO)_{10}$ and $^{187}Re_2(CO)_{10}$ formed $^{185}Re^{187}Re(CO)_{10}$, and this interchange was nearly complete at 150°C within 14 to 16 half-lives. All photochemically initiated reactions with the two labeled decacarbonyls led to complete crossover within short reaction times. It appears then that the primary mode of reaction for $Re_2(CO)_{10}$ under photolysis conditions involves Re-Re bond scission as an early elementary step. Also, the reversible steps leading to the precursor(s) to $Re_2(CO)_{10}$ decomposition include scission of the rhenium-rhenium bond.

**39184 Cyclopeptide alkaloids. Conformational analysis of the dihydro-p-phencyclopeptine nucleus.** Lagarias, J.C. (Univ. of California, Davis); Yokoyama, W.H.; Bordner, J.; Shih, W.C.; Klein, M.P.; Rapoport, H. *Journal of the American Chemical Society;* **105**: No. 4, 1031-1040(23 Feb 1983). Contract W-7405-ENG-48.

A combined NMR spectroscopic and x-ray crystallographic approach to the analysis of the conformations of two synthetic dihydro-p-phencyclopeptines, (5S)-5,6-trimethylene-8-deamino-1,2-dihydro-p-phencyclopeptine (2d) and its N-methyl derivative, (5S)-3-methyl-5,6-trimethylene-8-deamino-1,2-dihydro-p-phencyclopeptine (2a), is described. The one-dimensional $^{1}H$ NMR spectra of both cyclopeptides are assigned by means of two-dimensional homonuclear ($^{1}H$) J-spectral analysis, homonuclear decoupling experiments, computer-generated spectral simulations, and steady-state $^{1}H$ NOE measurements at 270 and 360 MHz. On the basis of Karplus relationships derived from these experimental results, together with $^{13}C$ NMR spectroscopic analysis, predictions for the solution conformations of both cyclopeptides are deduced. The solution conformation of the N-methyl cyclopeptide 2a is compared with its solid-state conformation determined by x-ray crystallography, and the two are

found to be in good agreement. Comparative NMR studies of the two p-phencyclopeptines reveal only subtle conformational differences between the two cyclopeptides. These differences occur in the region near the N3-C4 amide where the structural difference between the two cyclopeptides, the N-methyl group, is localized. Of the eight possible conformations of the p-phencyclopeptine nucleus, both cyclopeptides adopt the same overall geometry with both amides trans. The small conformational differences that do exist between 2a and 2d reflect the ability of NH cyclopeptide 2d to form an intramolecular hydrogen bond similar to those observed in the $\gamma$ turns in proteins. Conformational implications with respect to ion binding of the p-phencyclopeptines nucleus are considered.

**39185 Dynamical effects of symmetry along a reaction path: mode specificity in the unimolecular dissociation of formaldehyde.** Miller, W.H. (Lawrence Berkeley Lab., CA). *Journal of the American Chemical Society;* **105**: No. 2, 216-220(26 Jan 1983). Contract AC03-76SF00098.

If there is a geometrical symmetry (i.e., C/sub s/, C/sub 3v/, etc.) that is conserved along a reaction path (the steepest descent path in mass-weighted Cartesian coordinates from a transition state to reactants and to products), then it is shown that this leads to selection rules in the dynamical coupling between the reaction coordinate and the vibrational modes that are orthogonal to it: namely, states corresponding to different irreducible representations do not interact. Thus, even if one makes a statistical (i.e., transition-state theory) approximation to the dynamics within a given irreducible representation, i.e., a "symmetry-adapted transition-state theory", there can still be mode-specific effects between the different symmetries. The unimolecular decomposition of formaldehyde, $H_2CO \rightarrow H_2 + CO$, which has a planar reaction path, is taken as an example, and it is seen that the A' and A" microcanonical rate constants differ by a factor of $\sim$ 20 in the tunneling regime and still by a factor of 2 at $\sim$ 5-6 kcal/mol above the classical threshold of the reaction.

**39186 Infrared multiphoton decomposition of monosilane sensitized by silicon tetrafluoride.** Longeway, P.A.; Lampe, F.W. (The Pennsylvania State Univ., University Park). *Journal of Physical Chemistry;* **87**: No. 2, 354-358(20 Jan 1983). Contract AC02-76ER03416.

The decomposition of $SiH_4$ sensitized by the multiphoton absorption of unfocussed infrared laser radiation by $SiF_4$, has been studied at a fluence of 0.31 J/cm$^2$ and over a total pressure range of 3-16 torr. In contrast to the direct infrared multiphoton induced decomposition, the only volatile products observed are $H_2$ and $Si_2H_6$ which, within experimental error, are formed in equal amounts, It is proposed that collisional energy transfer from vibrationally excited $SiF_4$ produces internally excited $SiH_4$ to form $Si_2H_6$. The absence of $Si_3H_8$ and higher silanes in the volatile products, which is characteristic of other silane decomposition studies, is attributed to the absence of $SiH_2$ radicals and the fact that the $SiH_4$ molecules attacked by $SiH_2$ contain only that excess vibrational energy characteristic of thermal equilibrium at 300 K.

**39187 Kinetic isotope effect in the partial oxidation of propylene over $Bi_2O_3$.** Driscoll, D.J.; Lunsford, J.H. (Texas A&M Univ., College Station). *Journal of Physical Chemistry;* **87**: No. 2, 301-303(20 Jan 1983).

The allyl radical production during the partial oxidation of propylene and propylene-$d_6$ over $Bi_2O_3$ has been examined. Radicals were produces on a $Bi_2O_3$ catalyst, over the temperature range of 365-475°C, and trapped downstream in a solid argon matrix. The radical concentrations were determined by EPR spectroscopy and from these measurements the activation energies and kinetic isotope effects were calculated. The kinetic isotope effect results indicate that allyl radical formation is the rate-limiting step in the partial oxidation of propylene at moderate temperatures.

**39188 Theoretical models for solvation and catalysis in carbonyl addition.** Williams, I.H. (Univ. of Kansas, Lawrence); Spangler, D.; Femec, D.A.; Maggiora, G.M.; Schowen, R.L. *Journal of the American Chemical Society;* **105**: No. 1, 31-40(12 Jan 1983). Contract W-7405-ENG-48.

Alternative modes of catalysis of formaldehyde hydration by a single ancillary water molecule are investigated by ab initio calculations at the STO-3G level. A cyclic transition state (FW2 double dagger) involving formaldehyde with two molecules of water is characterized and is only 0.8 kcal mol$^{-1}$ higher in energy than the isolated reactants. The results indicate that gas-phase formaldehyde hydration probably proceeds via FW2 double dagger in a concerted mechanism with a Gibbs free energy of activation of 27 kcal mol$^{-1}$. Addition of a water dimer to formaldehyde via FW2 double dagger is predicted to occur in water with a Gibbs free energy of activation of 16 kcal mol$^{-1}$, in agreement with experiment. Empirical extrapolation to the liquid phase of entropies of activation calculated for reaction of one or two waters in the gas phase suggests that a mechanism involving three water molecules would be consistent with experiments for dioxan solution. Specific solvation by four water molecules is predicted to stabilize the zwitterionic adduct $H_3O^+CH_2O^-$ (an unbound state in the gas phase) by 111 kcal mol$^{-1}$ relative to $H_3O^+CH_2O^-$ and $4H_2O$ or by 37 kcal mol$^{-1}$ relative to $(H_2O)_3$ and $CH_2O.2H_2O$. Thus a stepwise mechanism for formaldehyde hydration also may be feasible, although the energy barrier to formation of a solvated zwitterionic intermediate has not yet been calculated.

**39189 Symmetry-adapted transition-state theory and a unified treatment of multiple transition states.** Miller, W.H. (Lawrence Berkely Lab., CA). *Journal of Physical Chemistry;* **87**: No. 1, 21-22(6 Jan 1983). Contract AC03-76SF00098.

It is shown how a recently discussed symmetry-adapted transition-state theory leads to a unified treatment of reactions that involve multiple transition states that are symmetry related. If the two (or more) transition states are well separated, the present description reduces to the standard prescription based on symmetry numbers, but it also applies more generally to the case that the transition states are close enough to interact dynamically, and even to the limit that they merge into a single transition state.

**39190 Structure of ionic micelles from small angle neutron scattering.** Bendedouch, D. (Massachusetts Inst. of Tech., Cambridge); Chen, S.H.; Koehler, W.C. *Journal of Physical Chemistry;* **87**: No. 1, 153-159(6 Jan 1983).

Extensive small angle neutron scattering (SANS) measurements were carried out on aqueous solutions of small anionic micelles of lithium dodecyl sulfate (LDS). Scattered intensity distributions were studied by varying the contrast as a function of both micellar core and solvent scattering length densities. Information regarding size, shape, aggregation number, and polydispersity of the micelles, and also water content of the inner hydrocarbon core, was extracted. Furthermore, the spatial distribution of the end groups of the dodecyl chains in the micelles was deduced from a selective deuteration of the methyl groups. Packing of the alkyl chains in the core has a degree of order between that for a completely disordered liquid state and a fully ordered all-trans radial configuration.

## 4004 Electrochemistry

*REFER ALSO TO CITATION(S) 38663, 38669, 39215*

**39191 (DOE/ER/10968—T1) Chemically modified carbon, nickel, and platinum electrodes. Technical progress report, 15 January 1980-30 May 1983.** Elliott, C.M. (Colorado State Univ., Fort Collins (USA). Dept. of Chemistry). 1983. Contract AC02-81ER10968;AC02-80ER10589. 23p. NTIS, PC A02/MF A01. Order Number DE83012680.

Portions are illegible in microfiche products.

Topics covered include: alkyl halide reduction at iron-porphyrin-polymer modified electrodes, polymeric viologen modified electrodes, heterodinuclear complexes of NiC$_4$TPP, bulk Nafion-thick film modified electrodes, ring-substituted bipyridine complexes of ruthenium and iron, electrochromic polymers from substituted bipyridine complexes of ruthenium, oxidations with high oxidation state metalloprophyrin, and other studies.

**39192 (SAND—83-1314C) Chemically induced interface states on semiconductor electrodes.** Butler, M.A.; Ginley, D.S. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-830508—21). NTIS, PC A02/MF A01. Order Number DE83013265.

From 163. Electrochemical Society meeting; San Francisco, CA, USA (8 May 1983).

Portions are illegible in microfiche products.

Sub-bandgap photocurrent spectroscopy has been used to observe interface states on GaP surfaces induced by treatment with various metal ions. In particular, Ru treatment induces a discrete level near the center of the gap which improves the ability of the electrode to evolve hydrogen. Such behavior is interpreted in terms of catalyzing the hydrogen evolution reaction rather than changing the surface recombination velocity as is observed in n-GaAs. Comparison of the effects of various ions suggests that the mechanism for generation of the interface states is the same as result in fermi level pinning during Schottky barrier formation.

**39193 (SERI/CP—233/1723, pp 134) Preparation and spectroelectrochemical studies of silicon modified with metallophosphine complexes.** DuBois, D.L. (Solar Energy Research Inst., Golden, CO). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39194 A new ferrocenophane surface derivatizing reagent for the preparation of nearly reversible electrodes for horse heart ferri-/ferrocytochrome c: 2,3,4,5-tetramethyl-1-((dichlorosilyl)methyl[2]-ferrocenophane.** Chao, S.; Robbins, J.L.; Wrighton, M.S. (Massachusetts Inst. of Tech., Cambridge). *Journal of the American Chemical Society;* **105**: No. 2, 181-188(26 Jan 1983).

Pt gauze electrodes functionalized with hydrolytically unstable 2,3,4,5-tetramethyl-1-((dichlorosilyl)methyl)[2]-ferrocenophane (I) exihibit persistent cyclic voltammetry waves consistent with a surface-confined redox couple, $PMFc^+/PMFc^0$, having an E/sup o'/ = +0.04 V vs. SCE in $H_2O$/1.0 M $NaClO_4$ at pH 7.0. Such electrodes will effect the one-electron reduction of horse heart ferricytochrome c (cyt c/sub ox/) to ferrocytochrome c (cyt c/sub red/ as well as the oxidation of cyt c/sub ox/, under conditions where the naked electrode does not effect such redox processes. n-type Si photoanodes functionalized with I will effect the uphill oxidation of cyt c/sub red/ upon ≧ E/sub g/ illumination and will effect cyt c/sub ox/ reduction in the dark. Derivatized electrodes are durable and do not significantly lose activity with use; a 4.4mM cyt c solution can be alternately exhaustively oxidized and reduced at +0.3 or -0.3 V vs. SCE in controlled-potential electrolyses for > 10 cycles without electrode deterioration. Electrodes derivatized with I come into charge-transfer equilibrium with cyt c/sub ox// cyt c/sub red/, E/sup o'/ = +0.02 V vs. SCE, via heterogeneous electron-exchange processes involving the $PMFc^+/PMFc^0$ redox centers; such electrodes can be used as potentiometric sensors for cyt c.

**39195 Inductive, steric, and environmental effects in the nonaqueous electrochemistry of hexakis(aryl isocyanide)chromium complexes.** Bohling, D.A.; Evans, J.F.; Mann, K.R. (Univ of Minnesota, Minneapolis). *Inorganic Chemistry;* **21**: No. 9, 3546-3551(Sep 1982).

The electrochemical behavior of a series of hexakis(aryl isocyanide)chromium(I) complexes has been studied by cyclic voltammetry. The inductive effects of para substituents on $E^{0'}$ for the (0 ⟷ 1+),(1+ ⟷ 2+), and (2+ ⟷ 3+) couples have been found to give linear correlations with the Hammett σ/sub p/ parameter. Solvent and supporting-electrolyte effects have also been investigated and are discussed in terms of donor/acceptor theory and ion-pairing effects, respectively. The introduction of bulky ortho substituents on the aryl isocyanide ring was found to dramatically influence both the $E^{0'}$/sub 3+///sub 2+/ and the substitutional lability of the $Cr(CNR)_6^{3+}$ complexes. These effects are attributed to significant weakening of the Cr/sup III/-C bonds in the ortho-substituted complexes relative to the para-substituted complexes due to steric interactions among the ortho substituents.

## 4005 Photochemistry

*REFER ALSO TO CITATION(S) 38579, 38659, 38661, 38662, 38663, 38664, 38665, 38666, 38667, 38668, 38672, 38675, 38679, 38680, 38682, 38683, 38690, 39219*

**39196 (SERI/CP—233-1723, pp 55-59) Structural aspects of photoinduced charge separation in micellar media.** Kevan, L. (Univ. of Houston, TX). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

**39197 (SERI/CP—233/1723, pp 68-70) Intramolecular energy transfer reactions in bimetallic transition metal complexes.** Petersen, J.D. (Clemson Univ., SC). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39198 (SERI/CP—233/1723, pp 73-76) Photochemical energy conversion and solution kinetics.** Creutz, C.; Sutin, N. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39199 (SERI/CP—233/1723, pp 84) Storage of photon energy in chemical intermediates through bimolecular photochemistry.** Frei, H.; Pimentel, G.C. (Univ. of California, Berkeley). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39200 (SERI/CP—233-1723, pp 85-86) Photochemistry of charge-transfer complexes: wavelength effects on ionic photodissociation.** Jones, G. II. (Boston Univ., MA). 1982. NTIS, PC A08/MF A01. (CONF-8206108—).

From 6. DOE solar photochemistry research conference; Boulder, CO, USA (8 Jun 1982).

**39201 (SERI/CP—233/1723, pp 97-100) Excited state properties of tris-porphyrin and bis-porphyrin-quinone triple decker molecular sandwiches. Geometric criteria for efficient charge transfer in model photosynthetic reaction centers.** Wasielewski, M.R. 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39202 (SERI/CP—233/1723, pp 105-107) Triplet states of chlorophylls.** Clarke, R.H. (Boston Univ., MA). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39203 (SERI/CP—233/1723, pp 115) Polynuclear metal complexes containing uranyl and transition metal ions.** Lintvedt, R.L. 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39204 (SERI/CP—233/1723, pp 116) Substituent probes of carbanion photoreactivity.** Tolbert, L.M.; Ali, M.Z. (Univ. of Kentucky, Lexington). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39205 (SERI/CP—233/1723, pp 117) Theoretical calculations of primary cation-anion states involved in photosynthesis and model systems.** Tang, J.; Closs, G.L.; Norris, J.R. 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

**39206 (SERI/CP—233/1723, pp 124) Actinometric systems for monochromatic flash photolysis studies: the quantum yields of triplet ZnTPP and chlorophyll.** Sinai, N.; Hurley, J.; Linschitz, H. (Brandeis Univ., Waltham, MA). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

39207 (SERI/CP—233/1723, pp 126) **Photophysics of chlorophyll and linked chlorophyll systems.** Hindman, J.C.; Hunt, J.E.; Schaber, P.M.; Katz, J.J. (Argonne National Lab., IL). 1982. NTIS, PC A08/MF A01.
In Sixth DOE solar photochemistry research conference.

39208 (SERI/CP—233/1723, pp 127) **Photolysis in the adsorbed state.** Sutherland, J.W. (Brookhaven National Lab., Upton, NY). 1982. NTIS, PC A08/MF A01.
In Sixth DOE solar photochemistry research conference.

39209 (SERI/CP—233/1723, pp 130) **Photochemistry of $d^6$ transition metal phtalocyanines. Charge transfer vs ligand centered photochemistry.** Ferraudi, G. (Univ. of Notre Dame, IN). 1982. NTIS, PC A08/MF A01.
In Sixth DOE solar photochemistry research conference.

39210 (SERI/CP—233/1723, pp 133) **Photochemical solar energy conversion in redox active and polymeric surfactant vesicles.** Fendler, J.H. (Clarkson Coll. of Tech., Potsdam, NY). 1982. NTIS, PC A08/MF A01.
In Sixth DOE solar photochemistry research conference.

39211 (SERI/CP—233/1723, pp 136) **Photodisproportionation of μ-OXO-BIS (tetraphenylporphinato iron (III)).** Richman, R.M.; Peterson, M.W. (Carnegie-Mellon Univ., Pittsburgh, PA). 1982. NTIS, PC A08/MF A01.
In Sixth DOE solar photochemistry research conference.

39212 **Direct observation of monophotonic photoionization in tryptophan excited by 300-nm radiation. A laser photolysis study.** Bazin, M.; Patterson, L.K.; Santus, R. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **87**: No. 2, 189-190(20 Jan 1983).

Direct observation of photoionization in aqueous tryptophan by laser photolysis at 280, 292, and 300 nm gives a constant value for the monophotonic quantum yield of hydrated electrons, phi = 0.075 +/- 0.02, over this range.These findings, along with previous studies at 265 nm, indicate uniform photoionization over the whole of the tryptophan near-UV band. Additionally, the yield of tryptophan triplet is found to be essentially constant over the same range.

39213 **Inclusion complexes between amphiphilic molecules and carboxymethylamylose in aqueous solution: ketone type II photoelimination behavior as a probe of the guest microenvironment.** Hul, Y.; Winkle, J.R.; Whitten, D.G. (Univ. of North Carolina, Chapel Hill). *Journal of Physical Chemistry;* **87**: No. 1, 23-25(6 Jan 1983). Contract AS05-81ER10815.

This paper reports a study of complex formation between two amphiphilic ketones and carboxymethylamylose and the photoreactiviy of the ketones in their respective inclusion complexes. The binding constants are found to increase as the chain length of the linear ketone (n in PhCO(CH$_n$)/sub n/COOH equals 3 and 10) increases. The CMA-included ketone is found to exhibit relatively low quantum efficiencies for the type II photoelimination process, the only reaction observed in each case. The results suggest that the ketone environment in the amylose cavities is relatively hydrophobic and conformationally restrictive; the photochemical reactivity observed is similar to that occurring for related ketones incorporated into bilayer vesicles below the phase transition temperature.

39214 **Specific hydrogen-bonding effects in the photophysics of β-Apo-14'-carotenal. Static and dynamic aspects of fluorescence and triplet yield quenching.** Das, P.K.; Hug, G.L. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **87**: No. 1, 49-54(6 Jan 1983).

Both fluorescence and triplet yields of β-apo-14'-carotenal ($C_{28}$ aldehyde) in cyclohexane at room temperature are quenched effectively by hydrogen bonding with alcohols. With 1,1,1,3,3,3-hexafluoro-2-propanol (HFIP) and 2,2,2-trifluoroethanol (TFE), the quenching interaction is separable into a static component arising from ground-state complexation and a dynamic component arising from hydrogen-bond formation in the singlet excited state; the contribution from the latter is found to be as important as that from the former. The Stern-Volmer constants (K/sub sv//sup F/) for fluorescence quenching (dynamic) are found to be smaller than those (k/sub sv//sup T/) for triplet yield quenching (dynamic). This observation concerning K/sub sv//sup F/ < K/sub sv//sup T/ is discussed in the light of schemes involving two kinetically distinguishable excited-singlet-state species-one responsible for fluorescence and the other acting as the predominant precursor of triplet.

39215 **Time-resolved photoelectrochemistry. A laser-induced coulostatic flash study of n-$TiO_2$ in acetonitrile.** Kamat, P.V.; Fox, M.A. (Univ. of Texas, Austin). *Journal of Physical Chemistry;* **87**: No. 1, 59-63(6 Jan 1983).

A laser-induced photoelectrochemical study of single crystal n-$TiO_2$ semiconductor electrodes, in native and chemically modified form, immersed in conductive electrolyte solutions in acetonitrile, has been carried out by employing time-resolved coulostatic flash techniques. A two-component response is seen for the rise in potential induced by flash excitation. The initial fast response, which occurs within about 10 ns, is attributed to electron-hole pair separation in the space charge layer. The slower response, initiated within 5 μs, involves redox-system responsive double layer effects and/or heterogeneous electron transfer at the electrode-electrolyte interface. In the presence of $Ru(bpy)_3^{2+}$, for example, the contribution of this second component to the overall photopotential was as high as 40%. The decay of the photopotential to dark equilibrium occurs through both $e^-$-$H^+$ recombination and dark charge-transfer processes. Silanization facilitated the electron-hole recombination process.

39216 **1-Phenyl-3,4:5,6-dibenzocycloheptatrienyl anion. A stable antiaromatic carbanion.** Tolbert, L.M.; Ali, M.K. (Univ. of Kentucky, Lexington). *Journal of Organic Chemistry;* **47**: No. 24, 4793-4795(19 Nov 1982).

This article describes the photochemical study of carbanions with the synthesis of 1,2,3-triphenylpropene and its cyclic analogue, 1-phenyl-3,4:5,6-dibenzocycloheptatriene. This synthesis allowed for the investigation of not only paratropic effects but also the potential destabilization induced by cyclization of an eight electron system. Results frm NMR spectroscopy revealed the presence of large upfield proton shifts in the presence of downfield carbon shifts for the cyclic as compared to acyclic anion presenting evidence that the 1-phenyl-3,4:5,6-dibenzocycloheptatrienyl anion is a carbocyclic antiaromatic species.

## 4006 Radiation Chemistry

*REFER ALSO TO CITATION(S) 38579*

39217 **(DOE/EV/03221—76) Chemical properties of OH radical and its role in biological processes. Progress report, July 1982-June 1983.** Czapski, G. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1983. Contract AC02-76EV03221. 9p. NTIS, PC A02/MF A01. Order Number DE83013387.

Portions are illegible in microfiche products.

Production of OH radicals may be by radiolysis, photolysis, or the Fenton reaction: $Fe^{2+} + H_2O_2 \rightarrow Fe^{3+} + OH^- + OH$. Physical properties of hydroxyl radicals in aqueous media are discussed. Chemical properties of the radicals are also considered. Reaction of the radicals and their importance in biology are also discussed.

39218 **(S—233-TP) Thermal quenching of some liquid scintillators.** Lutz, S.S.; Ashford, C.B.; Flournoy, J.M.; Franks, L.A.; Lyons, P.B. (EG and G, Inc., Goleta, CA (USA); Los Alamos National Lab., NM (USA)). 1983. Contract AC08-83NV10282. 14p. (CONF-830565—3). NTIS, PC A02/MF A01. Order Number DE83012400.

From Advances in scintillator counting conference; Banff, Alberta, Canada (15 May 1983).

Heating organic liquid scintillator solutions has proven to be an efficient way to improve the time response in some cases. Higher temperatures increase the rates of diffusion-controlled energy transfer processes in dilute solutions and in solutions with relatively high viscosity at room temperature. Under these conditions both the excitation rate and the rate of intermolecular quench-

ing, including concentration-quenching, become faster at higher temperatures. Except for specific concentration-quenching effects, little temperature dependence of the scintillator pulse parameters was observed in the more concentrated or in the less viscous systems.

39219 (SERI/CP—233/1723, pp 87-89) **Pulse radiolysis - flash photolysis spectroscopy. Reactions of photoexcited triplets with short-lived radicals.** Levanon, H.; Neta, P. (Univ. of Notre Dame, IN). 1982. NTIS, PC A08/MF A01.

In Sixth DOE solar photochemistry research conference.

## 4007 Radiochemistry And Nuclear Chemistry

*REFER ALSO TO CITATION(S) 38500, 39119, 39203*

39220 (CEA-N—2311) **Monodisperse polystyrene beads production and radioactive labelling for lung deposition and clearance investigations.** Roy, M.; Castillon du Perron, M.; Le Tohic, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Oct 1982. 27p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702040.

A technique for the preparation and labelling of polystyrene microspheres, micronic in diameter, has been developed, using the "spinning disc" method. Granulometric assays have been performed with non radioactive material. The radioactive manipulations require shielding, the technical achievement of which is described, in particular for the use of chromium 51 and technetium 99. The aim of these preparations is to study tracheobronchial and pulmonary clearances in the framework of nuclear medicine examinations.

39221 (INIS-mf—8072) **Discussion meeting on nuclear-, radio- and radiation chemistry - basics and applications.** (Gesellschaft Deutscher Chemiker, Frankfurt am Main (Germany, F.R.). Fachgruppe Nuklearchemie). 1982. 94p. (In German). (CONF-8209130—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780806.

From Meeting on nuclear-, radio- and radiation chemistry - basics and applications; Karlsruhe, F.R. Germany (20 Sep 1982).

Abstracts of individual items from the meeting were prepared separately for the data base. (GHT)

39222 (INIS-mf—8084) **11th AINSE radiation chemistry conference, 10th - 12th November 1982.** (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). 1982. 74p. (CONF-821187—Absts.). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83780804.

From 11. AINSE radiation chemistry conference; Lucas Heights, Australia (10 Nov 1982).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

39223 (NIIAR—28(481)) **Effect of ligand nature and geometry of its surrounding on electron absorption spectra of $NpO_2^{2+}$ and $PuO_2^{2+}$ compounds.** Sokolov, E.I.; Tebelev, L.G.; Melkaya, R.F.; Rykov, A.G. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1981. 25p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702042.

Electron absorption spectra are presented of actinide compounds with the symmetry of the nearest surrounding of actinyl-ions as follows: D/sub(2h)/-$AnO_3(NO_3)_3xnH_2O$, $AnO_3(CH_3COO)_3x2H_2O$; D/sub(3h)-$MAnO_2(NO_3)_3$ (M-K, Rb, Cs), $NaAnO_3(CH_3COO)_3$, $(NH_4)_4AnO_2(CO_3)_3$; D/sub(4h)-$Cs_2AnO_2Cl_4$, where An-U, Np, Pb, are measured at room temperature. It is established that position, intensity and form of absorption bands in neptunyl compound spectra are sensible equally to geometry of coordination sphere and to ligand nature. The character of the change of plutonyl compound spectra is the same as of neptunyl ones: it is determined both by surrounding geometry and chemical nature of ligands. It is shown that in the near infrared region ligand effect on plutonyl compound spectra with the symmetry of anion complex D/sub(3h)/ is weaker than in the visible region.

39224 **Cyclopentadienyl bonding in bis(cyclopentadienyl)neptunium(IV) compounds from $^{237}Np$ Moessbauer spectra.** Karraker, D.G. (Savannah River Lab., Aiken, SC). *Inorganic Chemistry;* 22: No. 3, 503-506(2 Feb 1983). Contract AC09-76SR00001.

$^{237}Np$ Moessbauer spectra were measured for a series of Np(IV) compounds of the general compositions $NpX_4$, $NpX_2Y_2$, and $NpX_3YY'$ [X = acac, bis(1-pyrazolyl)borate, tris(1-pyrazolyl)borate; Y, Y' = Cl, Cp, MeCp]. Comparison of the isomer shifts of the Moessbauer spectra showed no evidence for covalent bonding between the Cp ligand and Np(IV) in the $Cp_2Np$/sup IV/ and CpNp/sup IV/ moieties. It is proposed that ligand repulsion in $NpX_2$-$Cp_2$ and $NpX_2(MeCp)_2$ compounds lengthens the Np(IV)-Cp and Np(IV)-(MeCp) bonds and thus prevents any appreciable Np(IV)-ligand orbital overlap. Moessbauer magnetic splitting and quadrupole splitting parameters are greater for [tris(1-pyrazolyl)borato]neptunium(IV) compounds than for [bis(1-pyrazolyl)borato]neptunium(IV) compounds, a result attributed to the stronger field from the tridentate coordination of the tris(1-pyrazolyl)borate ligand.

39225 **Radiation safety aspects of a hot-cell decontamination.** Courtney, J.C. (Louisiana State Univ., Baton Rouge (USA). Nuclear Science Center); Ferguson, K.R.; Holson, C.E.; Bacca, J.P. (Argonne National Lab., IL (USA)). *Health Physics;* 43: No. 4, 465-480(Oct 1982).

Extensive decontamination was conducted to prepare the interior of the argon cell at the Hot Fuel Examination Facility for refurbishment. The radiation field associated with 10-16 yr-old fission products was reduced by remote cleaning before personnel entry. This paper describes the operations, dosimetry, protective clothing, hardware and procedures used to ensure compliance with radiation exposure guidelines. Contact decontamination was conducted in general radiation levels that varied from 300 to less than 30 mrem/hr for that component of the radiation that could penetrate 540 mg per $cm^2$ of aluminium. However, it was the nonpenetrating component that controlled in-cell stay times; it varied from 1500 to less than 130 mrem/hr. Even after decontamination, several areas of fixed contamination emitting over 1000 mrem/hr of nonpenetrating radiation were identified and locally shielded. There were 916 person-entries required for decontamination. These resulted in integrated exposures of 99 and 599 man-rem for the whole body and skin, respectively.

## 4008 Combustion, Pyrolysis, And High-temperature Chemistry

*REFER ALSO TO CITATION(S) 39189*

39226 (CSS/CI—83-23) **Spontaneous ignition characteristics of gaseous hydrocarbon-air mixtures.** Freeman, G.; Lefebvre, A.H. (Purdue Univ., Lafayette, IN (USA). Combustion Lab. ). Mar 1983. 16p. (CONF-830358—1). Purdue University, Thermal Sciences and Propulsion Center, The Combustion Lab., West Lafayette, IN.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

The purpose of the present paper is to present the results of some exploratory tests on spontaneous ignition delay that have been carried out at atmospheric pressure using gaseous propane-air mixtures. A series of experiments were conducted with the injection of additional oxygen or nitrogen into the flowing air stream, in order to obtain more accurate data on chemical delay times under conditions where the effects of fuel evaporation are excluded. Results indicate that ignition delay time is exponentially related to the initial mixture temperature and that delay times are shorter for shorter pipe lengths.

39227 (DOE/PC/40805—4) **Fundamentals of nitric oxide formation in fossil-fuel combustion. Fourth quarterly progress report, 29 June-28 September 1982.** Houser, T.; McCarville, M.E. (Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry). May 1983. Contract FG22-81PC40805. 19p. NTIS, PC A02/MF A01. Order Number DE83013605.

Experiments examining the oxidation of HCN and pyridine were continued using an atmospheric pressure flow system in order to determine the mechanism of NO formation from fuel-nitrogen combustion. In addition, several experiments with cyanogen, as well as a few with $N_2O$ as fuels were run. The results with cyanogen were significantly different than those with HCN in terms of reactivity and NO/sub x/ yields, thus it does not appear to be representative of fuel nitrogen during combustion. The few experiments with $N_2O$ gave a preliminary indication that if formed, it will not be a major contributor to NO/sub x/ formation subsequently; less than 15% conversion was observed. A large group of experiments between 575 and 675°C with HCN/CO mixtures at low to moderate extents of reaction were run to determine the rate parameters of $N_2O$ formation. It was evident that $N_2O$ increased with fraction HCN reacted. The kinetic equation that has described some of the data best at this intermediate stage of evaluation was derived from two first-order sequential reactions. The kinetic evaluation is continuing. A set of experiments with pyridine as the fuel indicated larger NO/sub x/ yields than with benzene/HCN mixtures and the drop in these yields was more gradual with contact time. In addition, determination of HCN yields indicate an inverse relationship between HCN and $N_2O$ formation. At these conditions NO is not a major product and the relationship between its formation and that of HCN and $N_2O$ is not clear. These experiments will be extended. Finally, during several of the lower temperature experiments with HCN/CO mixtures, a small but significant amount of white solid was observed to form. Attempts will be made to identify it. 7 tables.

**39228 (UCRL—88588) Contrast between natural and experimentally controlled fires in forced ventilated enclosures.** Alvares, N.; Foote, K. (Lawrence Livermore National Lab., CA (USA)). 6 May 1983. Contract W-7405-ENG-48. 41p. (CONF-830442—2). NTIS, PC A03/MF A01. Order Number DE83013038.

From CSNI specialist meeting on interaction of fire and explosion with ventilation systems in nuclear facilities; Los Alamos, NM, USA (26 Apr 1983).

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Controlled fire experiments in forced ventilated enclosures were done to provide accurate data with which to compare results from enclosure fire models. Methods for fire control include: limiting fuel geometry; defining fire duration; metering fuel flow rate and controlling ventilation rate. Concern that highly controlled fires may provide unrealistic conditions in enclosures prompted us to conduct several naturally burning fires as a test of comparative fire output performance criteria. Results of this comparison show that the deterministic control parameter for either natural or controlled fires is the ventilation rate: i.e., for fully ventilated conditions both natural and controlled fires produced very similar conditions.

**39229 Experimental studies of combustion in a two dimensional free shear layer.** Pitz, R.W.; Daily, J.W. (Univ. of California, Berkeley). pp 5.1-5.8 of Proceedings of symposium on turbulent shear flows, 2nd. London, England; Imperial College of Science and Technology (1979). (CONF-790721—).

From 2. symposium on turbulent shear flows; London, UK (2 Jul 1979).

The effect of combustion on the turbulent free shear layer formed at a rearward facing step has been studied. Schlieren movies confirm the importance of large scale vortices in determining entrainment and mixing behavior. The movies, long exposure schlieren photographs, and laser anemometry velocity profiles are used to observe the spreading rate of the layer and to study the vortex formation process. It is concluded that to first order, the primary effect of combustion is felt through the change in density ratio across the layer and acceleration of the flow due to volumetric expansion of the fluid in a confined duct.

# 42 ENGINEERING

*REFER ALSO TO CITATION(S) 38979*

## 4201 General Engineering

**39230 (ECN—83-017) Brazing. Compilation of literature references from January 1979 to July 1982.** Roemer, J.C. (Stichting Energieonderzoek Centrum Nederland, Petten). 1983. 296p. Stichting Energieonderzoek Centrum Nederland, Petten.

This report is a compilation of published literature on high temperature brazing covering the period 1979 to the middle of 1982. The references are listed alphabetically with regard to the base materials or combination of base materials to be brazed. Trade names are treated as base materials.

**39231 (EGG-M—19782) Process parameter effects on arc energy distribution.** Chan, J.W.; Key, J.F.; McIlwain, M.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 4p. (CONF-830485—2). NTIS, PC A02/MF A01. Order Number DE83013537.

From 64. annual American Welding Society meeting; Philadelphia, PA, USA (24 Apr 1983).

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A paper is summarized in which a model of the electric arc is presented which extends previous treatments to include electrode vertex angle. The model uses a semi-empirical approach to evaluate the localized arc current and potentials. Various arc properties have been calculated using a representative thermal distributation obtained for an argon shielded arc. Axial and radial currents, potentials, and delivered power distributions determined during these calculations will be presented in relation to electrode vertex angle. An improved version of the calculation which includes gas dynamic effects and heat transport in the molten pool will be presented. (LEW)

## 4202 Facilities And Equipment

*REFER ALSO TO CITATION(S) 38399, 38507, 38512, 38514, 38515, 38595, 39337, 39849*

**39232 (BNL—32245) Correlation of superconductor strand, cable, and dipole critical currents in CBA magnets.** Tannenbaum, M.J.; Garber, M.; Sampson, W.B. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 5p. (CONF-821108—31). D. Order Number DE83003951.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

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A calibration between vendor critical current data for 0.0268" diameter superconductor strand supplied to Fermilab, and the BNL $10^{-13}\Omega$cm critical current specification is presented. Vendor critical current data for over 400 Fermilab type billets are shown, both as supplied by the vendor and converted to BNL units. Predictions of cable critical current are made using the sum of the critical currents of the 23 strands, where all strands from the same half billet are assigned the same critical current. The measured critical current shows excellent correlation to the predicted value and is approximately 14 +- 2 percent below it. Colliding Beam Accelerator (CBA) full length dipoles reach the conductor critical current limit, essentially without training. Magnet performance is predictable from the measured critical current of a short sample of cable to within 2%.

**39233 (CEA-CONF—6350) Thermodynamical analysis of a double acting reciprocating magnetic refrigerator.** Lacaze, A.F.; Lacaze, A.A.; Beranger, R.; Bon Madion, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). May 1982. 5p. (CONF-820546—14). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701669.

From 9. international cryogenic engineering conference; Kobe, Japan (10 May 1982).

Methods of adiabatic demagnetization were limited until very recently to one-shot operations or to power levels below 1 mW. This paper describes the results of a reciprocating magnetic refrigerator operating between 1.8 K and 4.2 K, with a useful power greater than 1 watt. In this type of machine there are various problems associated with heat transfer between magnetic substance and heat sources and inside the substance itself. The refrigerator described here overcomes some of these problems and achieves good efficiency.

39234 **(CONF-830225—4) Transuranium processing plant.** King, L.J. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 13p. NTIS, PC A05/MF A01. Order Number DE83009791.

From Nuclear fuel cycle information workshop; Oak Ridge, TN, USA (15 Feb 1983).

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The Transuranium Processing Plant (TRU) is a remotely operated, hot-cell, chemical processing facility of advanced design. The heart of TRU is a battery of nine heavily shielded process cells housed in a two-story building. Each cell, with its 54-inch-thick walls of a special high-density concrete, has enough shielding to stop the neutrons and gamma radiation from 1 gram of 252/sub Cf/ and associated fission products. Four cells contain chemical processing equipment, three contain equipment for the preparation and inspection of HFIR targets, and two cells are used for analytical chemistry operations. In addition, there are eight laboratories used for process development, for part of the process-control analyses, and for product finishing operations. Although the Transuranium Processing Plant was built for the purpose of recovering transuranium elements from targets irradiated in the High Flux Isotope Reactor (HFIR), it is also a highly versatile facility which has extensive provisions for changing and modifying equipment. Thus, it was a relatively simple matter to install a Solvent Extraction Test Facility (SETF) in one of the TRU chemical processing cells for use in the evaluation and demonstration of solvent extraction flowsheets for the recovery of fissile and fertile materials from irradiated reactor fuels. The equipment in the SETF has been designed for process development and demonstrations and the particular type of mixer-settler contactors was chosen because it is easy to observe and sample.

39235 **(ECN—82-159) Development of high current $Nb^3Sn$ multifilament superconducting material following the ECN powder method and growth kinetics and characterization of superconducting properties of multifilament materials made by the ECN powder method.** (Stichting Energieonderzoek Centrum Nederland, Petten). Nov 1982. vp. (CONF-821108—Exc.). Stichting Energieonderzoek Centrum, Petten, Netherlands.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

Items in EDB scope were entered separately. (LEW)

39236 **(LBL—16127) Chaos and noise in Josephson tunnel junctions.** Clarke, J.; Miracky, R.F.; Martinis, J.; Koch, R.H. (Lawrence Berkeley Lab., CA (USA); IBM Watson Research Center, Yorktown Heights, NY (USA)). May 1983. Contract AC03-76SF00098. 12p. (CONF-830595—1). NTIS, PC A02/MF A01. Order Number DE83013686.

From 7. international conference on noise in physical systems; Montpellier, France (16 May 1983).

The current-voltage characteristics of Josephson tunnel junctions shunted by a conductance with substantial self-inductance exhibit regions of stable negative resistance. At certain values of bias current, the junctions exhibit chaos, which is manifested as a low frequency voltage noise equivalent to a noise temperature of about $10^3$K. At other bias points, switching between subharmonic modes or between a subharmonic mode and a chaotic regime produces low frequency noise with a noise temperature often exceeding $10^6$K. Analog simulations indicate that, at least under some conditions, the switching is induced by intrinsic thermal noise. The analog has also been used to show that switching induced by thermal noie is responsible for the noise rise observed experimentally in three-photon Josephson parametric amplifiers.

39237 **(N—8314691) Assessment of alternative power sources for mobile mining machinery.** Cairelli, J.E.; Tomazic, W.A.; Evans, D.G.; Klann, J.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Dec 1981. 109p. (NASA-TM—82695; E—978). NTIS, PC A06/MF A01.

Alternative mobile power sources for mining applications were assessed. A wide variety of heat engines and energy systems was examined as potential alternatives to presently used power systems. The present mobile power systems are electrical trailing cable, electrical battery, and diesel - with diesel being largely limited in the United States to noncoal mines. Each candidate power source was evaluated for the following requirements: (1) ability to achieve the duty cycle (2) ability to meet Government regulations (3) availability (production readiness) (4) market availability and (5) packaging capability. Screening reduced the list of candidates to the following power sources: diesel, stirling, gas turbine, rankine (steam), advanced electric (batteries), mechanical energy storage (flywheel), and use of hydrogen evolved from metal hydrides. This list of candidates is divided into two classes of alternative power sources for mining applications, heat engines and energy storage systems.

39238 **(NLCO—1181) Safety analysis report for packaging - Mark 15 core shipping container. Work period FY-1982.** Dolan, L.C. (NLO, Inc., Cincinnati, OH (USA)). Feb 1983. Contract AC05-76OR01156. 96p. NTIS, PC A05/MF A01. Order Number DE83012959.

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An analytical evaluation of the Mark 15 enriched uranium (1.1 wt % $^{235}$U) Core Shipping Container has been made in order to demonstrate its compliance with regulations governing the offsite shipment of radioactive materials. The evaluation encompasses four primary categories: structural integrity, thermal integrity, nuclear criticality safety and quality assurance. The results of this evaluation show that the Mark 15 Core Shipping Container complies with the regulations as outlined in 10CFR71.

39239 **(ORNL/ENG/TM—5/Rev.1) Safety analysis report for packaging: the ORNL gas-cylinder fire and impact shield.** Evans, J.H.; Levine, D.L.; Eversole, R.E.; Mouring, R.W. (Oak Ridge National Lab., TN (USA)). Apr 1983. Contract W-7405-ENG-26. 112p. NTIS, PC A06/MF A01. Order Number DE83013737.

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The ORNL gas-cylinder fire and impact shield was designed and fabricated at the Oak Ridge Gaseous Diffusion Plant for the transport of cylinders filled with radioactive gases. The shield was evaluated analytically and experimentally to determine its compliance with the applicable regulations governing containers in which radioactive and fissile materials are transported, and the results are reported herein. Computational and test procedures were used to determine the structural integrity and thermal behavior of the cask relative to the general standards for normal conditions of transport and the standards for hypothetical accident conditions. Results of the evaluation demonstrate that the container is in compliance with the applicable regulations.

39240 **(PB—83-171991) Development of improved seatbelt systems for surface mining equipment. Open file report (final) 1980-81.** Carlson, L.E.; Hoffman, A.G. (Mobility Systems and Equipment Co., Los Angeles, CA (USA)). 30 Oct 1981. 129p. NTIS, PC A07/MF A01.

Tasks required in the development of Improved Seatbelt Systems included a literature and information search, development and test of a prototype seatbelt system, production of field test systems, field tests and evaluation of the field test results. Field test seatbelt systems were of a retractable sheathed design having automatic locking and manual locking features. Results indicate mining equipment operator acceptance of seatbelts were enhanced by the design features of the improved seatbelt systems.

39241 **(SAND—82-1991C) Three-dimensional finite element analysis of radioactive material packagings.** Sutherland, S.H.; Huerta, M. (Sandia National Labs., Albuquerque, NM (USA); Southwest Engineering Associates, El Paso, TX (USA)). 1983. Contract AC04-76DP00789. 9p. (CONF-830528—40). NTIS, PC A02/MF A01. Order Number DE83013630.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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In this paper the use of three-dimensional finite element analysis of radioactive material packagings is considered by applying the technique to a new Type B container. First the steps and resources required to perform a three dimensional finite element analysis are discussed. Next the packaging example and load cases considered ared described. Finally, results of the analyses are presented to illustrate the information obtained.

39242 **(SAND—82-1994C) Experimental and analytical program to evaluate packaging and target hardness as related to nuclear waste transportation systems.** Sutherland, S.H.; Allen, G.C.; Yoshimura, H.R.; Huerta, M. (Sandia National Labs., Albuquerque, NM (USA); Southwest Engineering Associates, El Paso, TX (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830528—28). NTIS, PC A02/MF A01. Order Number DE83013471.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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This paper describes a portion of an analytical/experimental program being conducted to determine the effects of target and packaging characteristics on the structural response of containers subjected to impact tests. As described, the experimental portion of the program will utilize half-scale models of a generic high-level radioactive material shipping cask. The models will be impacted at different velocities, in an end-on orientation, into a steel faced target, a concrete target, a typical soil and other materials as needed to envelope other potential target effects. The analytical studies are being conducted with a dynamic finite-element computer program which calculates the detailed response of the container under the different impact conditions. The results of the analyses indicate that a slight amount of yielding in the target can substantially reduce the amount of damage that a container sustains compared to using a very rigid target. Results of the analytical studies are to be compared to the experimental results from tests which are currently being conducted.

39243 **(SAND—83-0046C) 2 MJ staged explosive generator.** Cnare, E.C.; Kaye, R.J.; Cowan, M. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 3p. (CONF-830621—18). NTIS, PC A02/MF A01. Order Number DE83013677.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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A self-contained, three stage explosive generator is described. The system has produced 2 MJ of magnetic energy in a 40 nH load with a peak VI product of 0.2 TW. Current in the load rises from zero to peak value in 50 μs, the later part of the rise being approximately exponential with 10 μs e-fold time. Support equipment (power supply, initial energy capacitor bank, detonator firing units, delay generators, and Freon gas supply) can be protected from destructive effects of the explosive generators and reused.

39244 **(SAND—83-0121C) RAVEN, a 5-kJ, 1.5-MV repetitive pulser.** Rohwein, G.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 4p. (CONF-830621—19). NTIS, PC A02/MF A01. Order Number DE83013643.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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RAVEN, a 5 kJ, 1.5 MV repetitive pulser, was built to test the performance of high voltage transformer pulse-charging systems. The pulser has a 4 nF water-insulated, pulse-forming line which is charged by a bipolar primary capacitor bank through a voltage step up pulse transformer. Both the primary capacitor and high-voltage output switches are gas dynamic spark gaps which have been operated at sustained pulse rates up to 20 pps. The system operates with an overall energy transfer efficiency slightly better than 90%. A description of the system and its performance characteristics will be discussed. Specific design features of the switches and transformer will also be included.

39245 **(SAND—83-0228C) High-average-power rep rate systems.** Buttram, M. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830621—23). NTIS, PC A02/MF A01. Order Number DE83013769.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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Insulation, switching, voltage amplification, and beam generation, all of these aspects of pulsed power offer new challenges as systems move from single pulses to repetitive operation. The status of each is briefly reviewed.

39246 **(SAND—83-0333C) 3 MJ capacitor bank for the SNL Electroexplosive Facility.** Cnare, E.C.; Dobbie, C.B. (Sandia National Labs., Albuquerque, NM (USA); Maxwell Labs., Inc., San Diego, CA (USA)). 1983. Contract AC04-76DP00789. 3p. (CONF-830621—16). NTIS, PC A02/MF A01. Order Number DE83013675.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

A 3-MJ capacitor bank has been added to the Sandia National Laboratories Electroexplosive Facility for injecting the initial magnetic energy into large explosive generators of a new design. It consists of two 800-μF modules that are first charged to +60 kV and -60kV, respectively, and then discharged in series by explosive detonator switches to provide 400 μF at 120 kV. The bank has been designed to deliver priming currents up to 2 MA and to have an energy transfer efficiency of 0.7 to 0.84 for generator inductance of approximately 10 μH. Type 17/14 coaxial cable will be used to interconnect the capacitor modules, detonator switches, and load. All generators primed by this bank will be crowbarred at the time of peak current to limit capacitor voltage reversal and extend the life of the capacitors. This paper describes the major components of the system.

39247 **(SAND—83-0808C) Finite-element circuit model of helical explosive generators.** Cowan, M.; Kaye, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-830621—22). NTIS, PC A02/MF A01. Order Number DE83013676.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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A finite-element model for helical explosive generators (MCG's) is briefly described. Several features distinguish it from those previously published. Flux losses due to the moving point of contact between coil and armature are accounted for with a new term in the circuit equation. The term is required since flux which has diffused into the conductors is not lost from the circuit until it is actually switched out by the point of contact. Induced currents in the armature are considered to flow in a circuit which is separate from, but coupled to the load/coil circuit. Conductor ohmic losses are calculated using heat dependent resistivities and a new approximation for proximity effect. Wire branching (turn splitting) is also accounted for and the model can be used for generators operating in the inductively coupled (flux-trap) cascade mode. Comparison between calculated and measured performance will be presented for explosive generators which differ widely in size and design.

39248 **(SAND—83-1993C) Packaging test facilities at Sandia National Laboratories.** Allen, G.C.; Bickel, D.C.; Mathews, F.H.; Keltner, N.R. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 15p. (CONF-830528—35). NTIS MF A01. Order Number DE83013264.

From 7. international symposium on packaging and transportation of radioactive materials; New Orleans, LA, USA (15 May 1983).

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Many unique facilities exist at Sandia National Laboratories which can be used for completing a range of performance tests on radioactive material packagings or component sections. Both regulatory and extra-regulatory test environments can be simulated. Key factors in the successful utilization of these facilities are the analysis, instrumentation, and support services available and the experience base that has been established during the development and certification testing of a significant number of radioactive material packagings.

39249 **(UCID—19784) MSAD actuator solenoid, performance evaluation and modification.** North, G. (Lawrence Livermore National Lab., CA (USA)). 19 Apr 1983. Contract W-7405-ENG-48. 24p. NTIS, PC A02/MF A01. Order Number DE83011216.

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A small conical-faced solenoid actuator is tested in order to develop design criteria for improved performance including increased pull sensitivity. In addition to increased pull for the normal electrical inputs, a reduction in pull response to short duration electrical noise pulses is also required. Along with dynamic testing of the solenoid, a linear circuit model is developed. This model permits calculation of the dynamic forces and currents which can be expected with various electrical inputs. The model parameters are related to the actual solenoid and allow the effects of winding density and shading rings to be evaluated.

39250 **(UCRL—88624) High-current railgap studies.** Druce, R.; Gordon, L.; Hofer, W.; Wilson, M. (Lawrence Livermore National Lab., CA (USA)). 3 Jun 1983. Contract W-7405-ENG-48. 5p. (CONF-830621—25). NTIS, PC A02/MF A01. Order Number DE83013859.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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Characteristics of a 40-kV, 750-kA, multichannel rail gap are presented. The gap is a three electrode, field-distortion-triggered design, with a total switch inductance of less than 10 nH. At maximum ratings, the gap typically switches 10 C per shot, at 700 kA, with a jitter of less than 2 ns. Image-converter streak photographs were used to study channel evolution and current division. Transient gas-pressure measurements were made to investigate the arc generated shocks and to detect single channel failure. Channel current sharing and simultaneity are described and their effects on the switch inductance and lifetime are discussed. Lifetime tests of the rail gap were performed. Degradation in the channel current-sharing and erosion measurements are discussed.

39251 **Performance of an internally cooled superconducting solenoid.** Lue, J.W.; Miller, J.R. (ORNL, Oak Ridge, TN). pp 227-234 of Advances in Cyrogenic Engineering, Vol. 27. Fast, R.W. New York, NY; Plenun (1982). (CONF-810835—).

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

A superconducting magnet constructed of ICS has been built and tested. Particular emphasis was placed on measurement of the stability margins of the magnet. Test results showed that this magnet has demonstrated several merits which are listed in the study. The solenoid construction is described as well as the instrumentation and test set-up. The parameters of the conductor and coil are itemized. Magnet performance is discussed in terms of quench field, stability margins and pulse fields. Discussion is appended concerning comparable performance for similar bath cooled cable. Final discussion concerned the operating current to critial current ratio, which is about 30%.

39252 **Steady-state heat transfer to boiling liquid helium in simulated coil windings.** Walstrom. (ORNL, Oak Ridge, TN). pp 319-326 of Advances in Cyrogenic Engineering, Vol. 27. Fast, R.W. New York, NY; Plenum (1982). (CONF-810835—). Contract W-7405-ENG-26.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Data is shown in which the worst case steady state stability in the General Electric Large Coil Test magnet windings is at a horizontal conductor orientation. The heat transfer improves with inclination of the conductor from horizontal. Calculations show that for these small regions normal zones will recover by cold-end conduction from the inclined conductor on either end. The test bundle configuration and test procedures are presented and the winding pack elements illustrated. Relevant computer-generated plot of temperature vs time is shown along with curves of steady-state heating power density vs temperature rise above the bath temperature for different situations. Conclusions include a table of comparison between steady-state cryostability parameters for the pool-boiling LCT coils.

39253 **Measurements of heat transfer to He II at atmospheric pressure in a confined geometry.** Warren, R.P.; Caspi, S. (Lawrence Berkeley laboratory, Univ. of California, Berkley, CA). pp 459-466 of Advances in Cyrogenic Engineering, Vol. 27. Fast, R.W. New York, NY; Plenum (1982). (CONF-810835—).

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The attenuation of the heat transfer in typical designs is measured, in which cooling passages between turns are provided by gaps in the electrical insulation, and are typically a fraction of a millimeter wide. The experimental apparatus is described and illustrated. The experimental procedure is presented with the test results shown with characteristics shown in graphs. Critical heat flux is discussed with heat transfer at the lambda point and critical heat flux shown in graphs. Surface conductance is defined with aspects illustrated. Conclusions include the finding that appreciable heat flux densities are possible in pressurized He II.

## 4203 Lasers

*REFER ALSO TO CITATION(S) 39868*

39254 **385 $\mu m D_2O$ laser line width measurements to -60dB.** Woskoboinikow, P.; Erickson, R.; Mulligan, W.J. (Plasma Fusion Ctr, Massachusetts Instit. of Tech, Cambridge, MA 02139). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **19**: No. 1, 4-6(Jan 1983). Contract AC02-78ET51013.

First linewidth measurements over a 60 dB dynamic range of a pulsed, high-power, optically pumped far infrared laser are presented. These measurements were made possible by using a 385 $\mu m D_2O$ laser with an $N_2O$ absorption filter and a sensitive heterodyne receiver. Studying a 385 $\mu m D_2O$ laser oscillator we find that the low-level linewidth ($\leq$ -20 dB) can be explained by the ac Stark effect due to the high-power pump field. Also, the authors have not observed any frequency pulling of the main Raman emission frequency due to the strong pump and FIR laser fields.

39255 **Gain saturation in phosphate laser glasses.** Yarema, S.M.; Milam, D. *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **18**: No. 11, 1941-1946(Nov 1982). Contract W-7405-ENG-48.

Saturation of gain at 1053 nm was studied in seven Nd-doped phosphate glasses. Values of saturation fluence measured with 1.4-ns pulses were slightly less than those measured with 20-ns pulses. At both pulse lengths, saturation fluence increased with output fluence. For the seven glasses, the product of saturation fluence and gain cross section was constant to within +6 percent.

39256 **Transition of liquid carbon dioxide to gas-solid mixture.** Fomin, N.A. (Akademiia Nauk Belorusskoi SSR, Institut Teplo- i Massoobmena, Minsk, Belorussian SSR); Labuda, S.A. pp 503-507 of Flow visualization II. Washington, DC; Hemisphere Publishing Corp. (1982). (CONF-8009292—).

From International symposium on flow visualization; Bochum, F.R. Germany (9 Sep 1980).

An attempt to describe the mechanisms produced in the injection of an aerosol jet into the supersonic stream of a gasdynamic laser is presented. The jet consists of the expansion of high pressure liquid $CO_2$, and was examined by means of holographic images of the flow and high speed cinematography of the flow patterns. The nozzle throat was varied from 0.4-2 mm for injection into the atmosphere from a plenum chamber maintained at -10 to 20 C. It was observed that at first the liquid jet boiled and broke into streamers, and large bubbles entering the nozzle caused unstable flows. In a second stage, the streamers formed liquid drops which froze into dry ice, the whole process occurring in a 0.1-2 mm span near the diverging section of the nozzle throat. Complete choking of the nozzle flows, resulting in unsteady flows, was found in a plenum temperature range -5 to 5 C.

39257 **Electro-optics/Laser International '80 UK Proceedings of the Conference, Brighton, England, March 25-27, 1980.** Jerrard, H.G. (ed.). Guildford, Surrey, England; IPC Science and Technology Press (1980). 408p. (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

Papers are presented concerning recent developments in the fields of electro-optics, particularly as it relates to the use of lasers, and other laser applications. Specific topics include loss measurements in graded index compound glass optical fibers, coherent optical two-dimensional signal analysis for picture deblurring applications, applications of the high-resolution holography of large volumes, laser speckle vibrometry for measurements of microscopic motions at audio frequencies, laser hazard control under field conditions, laser coupling to a gaseous medium through resonance saturations, a time-of-flight laser anemometer for remote wind velocity measurement, an electron-beam-pumped excimer laser system, the evaluation of thermal imaging systems, and a flat-plate capacitor discharge $N_2$ laser.

39258 **Techniques for single mode selection and stabilization in helium-neon lasers at 1.15 micron wavelength.** Joynes, G.M.S.; Wiseman, R.B. (Plessey Electronic Systems Research, Havant, Hants., England). pp 163-171 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

39259 **The cause of low damage threshold of fluorophosphate glass.** Izumitani, T.; Asahara, Y. (HOYA Corp., Akishima, Tokyo, Japan). pp 172-179 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technolgy Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

The probable reasons for the low laser damage thresholds observed in fluorophosphate glasses, which are under consideration as the Nd-doped amplifier glass to be used in high-power laser systems, are discussed. Following a review of the nature of the intrinsic and extrinsic mechanisms of internal damage upon laser irradiation, the relation between thermal endurance and damage threshold is examined for fluorophosphate laser glass and silicate and phosphate glasses, and an approximate linear relation is noted. Comparison of the thermal and mechanical properties and the damage thresholds of phosphate and fluorophosphate glasses with various levels of P2O5, and fluorophosphate glass prepared in a Pt crucible reveals the low damage threshold of fluorophosphate glass to be associated with its low phosphoric oxide content and weak network structure, with further decreases caused by Pt inclusions.

39260 **A fieldable short pulse, high energy laser transmitter.** Osborn, D.B.; Malitson, P.H. (General Photonics Corp., Santa Clara, CA). pp 207-209 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

A cavity-dumped, YAG oscillator-amplifier system has been built which offers significant advantages over conventional Q-switched and mode-locked systems. Pulse risetime of one nanosecond and pulsewidth of two nanoseconds has been achieved with greater than two hundred millijoule output at 532 nm. The system design is simple and straightforward, as opposed to the complex and difficult to operate mode-locked systems. It is provided in a fieldable configuration, making it quite attractive for ranging, tracking, remote sensing and nonlinear studies.

39261 **High power CW single longitudinal mode operation in narrow channel Double Carrier Confined (DCC) injection lasers.** Stockton, T.E.; Gill, R.B.; Klein, R. (Laser Diode Labs., Inc., New Brunswick, NJ). pp 277-280 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

39262 **New generation semiconductor CW laser packages with full hermeticity, integral power monitoring and direct fibre optic launching.** Ashton, J.E.U. (ITT Components Group, Paignton, Devon, England); Gibb, R.M. pp 281-290 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

39263 **A compact electron beam pumped excimer laser system.** Hutchinson, M.H.R.; Smith, P.W. (Imperial Coll., of Science and Tech., London, England). pp 291-296 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

A new versatile excimer laser system has been developed which provides megawatt powers of VUV and UV radiation. By employing electron beam pumping, the system offers a wider range of laser wavelengths at higher energies and peak powers than the discharge pumped rare gas halide lasers. The system comprises of a pulsed power supply and three easily interchangeable laser heads. Two of the laser heads use coaxial electron beam diodes to pump the rare gas and rare gas halide excimers respectively. The third head uses the electron beam sustained discharge technique for long pulse pumping of the rare gas halide excimers.

39264 **Design considerations of a flat-plate capacitor discharge $N_2$ laser.** Ahmad, S.R. (Royal Military Coll., of Science, Shrivenham, Wilts., England). pp 366-374 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

A simple, safe and compact, flat and folded transmission line type capacitor discharge $N_2$ laser is described. Under optimum operating conditions peak output power up to 3MW in 6nsec (FWHM) pulses have been achieved. Pulse repetition frequency is limited to about 25Hz at high operating voltages. Depending on the position of the sparkgap switch, a travelling wave type excitation is observed. The efficiency of the laser is found to be better than 0.8%. The optimum pressure p for maximum output is found for various sparkgap breakdown voltages and E/p is found to be approximately 10.5 V/(mm.mbar).

## 4204 Heat Transfer And Fluid Flow

*REFER ALSO TO CITATION(S) 38465, 39252, 39327*

**39265 (SAND—83-8229) Gas-transfer analysis. Section H - real gas results via the van der Waals equation of state and virial expansion extension of its limiting Abel-Noble form.** Chenoweth, D.R. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1983. Contract AC04-76DP00789. 78p. NTIS, PC A05/MF A01. Order Number DE83013281.

An ideal-gas, quasi-steady, duct-flow model previously formulated for small scale gas-transfer problems is extended to real gases via the van der Waals equation of state as well as general virial expansions. The model is applicable for an arbitrary series of ducting components where each is described empirically by total pressure and total temperature change correlations. The adequacy of the van der Waals model for gas-transfer calculations is verified by comparisons with: (1) real gas PVT data; (2) the magnitudes of the controlling effects; and (3) approximate limiting case solutions with numerical results using more accurate real-gas modeling. 25 figures.

**39266 Automatic measurements of heat load.** Kuchnir, M. (Fermi National Accelerator Lab., Batavia, IL). pp 1205-1210 of Advances in Cyrogemic Engineering, Vol. 27. Fast, R.W. New York, NY; Plenum (1982). (CONF-810835—).

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

Measuring the pressure of the heat load into the helium temperature region of a component is discussed. The method is described which is used to determine heat loads of individual Energy Saver components, dipole magnets, quadrupole magnets and "spool pieces" which are cryostats containing the higher order correction magnets and most of the accessories of a cryogenic nature. The procedure for testing is described and the data acquisition system is shown with schematic for heat load measurements of the testing facility. Heat load measurements are presented with results for one Energy Saver dipole and one Energy Saver quadrupole magnet given. Sixteen vendors are listed with addresses.

**39267 Flow visualization II Proceedings of the Second International Symposium, Bochum, West Germany, September 9-12, 1980.** Merzkirch, W. Washington, DC; Hemisphere Publishing Corp. (1982). 815p. (CONF-8009292—).

From International symposium on flow visualization; Bochum, F.R. Germany (9 Sep 1980).

Applications, techniques, instrumentation, and interpretation of flow visualization are discussed. Methods of using flow visualization for the examination of combustion in furnaces, heat transfer with heat exchangers, and in fluid engines are explored, along with flow visualization in food processing, steel-casting, and process engineering. Further attention is given to pipe and channel flow, flow separation in laminar flow and around oscillating airfoils, wakes and vortices, supersonic flow and shock waves, and stratified flow and oceanography. The visualization of boundary layers is considered for various conditions, and applications for multiphase flow, rheology, and medical problems are detailed. Oil film, dry-surface coating, chemical, fluorescent, and minituft methods are presented, as well as the use of tracers, optical techniques, strobe lights, lasers, computerized data acquisition, and hot-wire anemometry.

## 4205 Materials Testing

**39268 (HEDL-SA—2796-FP) Thermal nondestructive examination method for thermal-spray coatings.** Green, D.R.; Schmeller, M.D.; Sulit, R.A. (Hanford Engineering Development Lab., Richland, WA (USA); Puget Sound Naval Shipyard, Bremerton, WA (USA); Naval Sea Systems Command, Washington, DC (USA)). May 1983. Contract AC06-76FF02170. 16p. (CONF-830574—1). NTIS, PC A02/MF A01. Order Number DE83012154.

From International thermal spray conference; Essen, F.R. Germany (2 May 1983).

This paper describes a feasibility demonstration of a thermal scanning NDE (nondestructive examination) system for thermal-spray coatings. Non-bonds were detected between several types of coatings and their substrates. Aluminum anti-skid coatings having very rough surfaces were included. A technique for producing known non-bond areas for calibrating and demonstrating NDE methods was developed.

**39269 (SAND—82-2186) Characterization of conservatism in mechanical shock testing of structures.** Baca, T.J. (Sandia National Labs., Albuquerque, NM (USA)). May 1983. Contract AC04-76DP00789. 191p. NTIS, PC A09/MF A01. Order Number DE83013524.

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The objective of this research is to characterize field and test environments in a way that will allow quantitative statements to be made about the conservatism of a shock test. Alternative characterizations of shock transients are introduced which compensate for the limitations of absolute acceleration shock spectra in representing shock environments. A method of characterizing both field and laboratory shock environments is developed which can be used for any type of shock characterization to account for the variability in the description of the environments. Conservatism between the field and laboratory shock environments is then quantified in terms of the index of conservatism (IOC). The IOC can be calculated for any response characteristic of interest. This measure of conservatism possesses the attribute of incorporating information on the uncertainty in either of the shock environments. Control of the level of conservatism in a shock test in terms of a given response characterization is shown to be possible through the derivation of test modification factors associated with desired IOC values. These shock data analysis procedures are demonstrated using field and shock laboratory data measured on a simple cantilever beam structure. The development of this new method for defining conservatism in mechanical shock testing provides a capability for controlling the degree of conservatism in shock tests which is not currently available.

**39270 (UCRL—15501) Scattering of elastic waves. Final technical report, January 1, 1981-September 30, 1982.** Mal, A.K. (California Univ., Los Angeles (USA); Lawrence Livermore National Lab., CA (USA)). 9 Sep 1982. Contract W-7405-ENG-48. 448p. NTIS, PC A19/MF A01. Order Number DE83013574.

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The major objective of the research was to generate solutions of a number of crack diffraction problems which have potential applications in the ultrasonic nondestructive evaluation of structural elements. Only simplified prototype problems were considered so that their solutions could be obtained without recourse to highly elaborate numerical schemes. The emphasis was on obtaining accurate results for idealized geometries which could serve as standards for evaluating numerical or other approximate solutions of more realistic and complex models. Problems considered were: diffraction of normally incident P waves by circular cracks, diffraction of elastic waves by a finite crack within or on a half space, diffraction of body and surface waves at high frequencies by an edge crack in a plate, and the surface response of a layered half space to dislocation sources. (LEW)

**39271 (UCRL—89378) Field metallography aids NDT of evaluaton of indications in turbine main-column horizontal-plate welds at power plant.** Diaz, D.J.; Benson, S.E. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 21p. (CONF-830759—1). NTIS, PC A02/MF A01. Order Number DE83013581.

From 16. annual technical meeting of the International Metallographic Society; Calgary, Canada (25 Jul 1983).

An evaluation of indications in the main turbine building column horizontal plate welds was conducted by the joint efforts of field metallography and nondestructive examinations. The turbine building main column horizontal plate welds were selected at random and were inspected to find discontinuities, metallurgical evaluation of the discontinuities, analysis of any failure modes, and determination of the best repair techniques. The welds were made with prequalified joints in accordance with AWS D1.1-77 and required only visual inspection. More sensitive inspection methods were applied to the welds in order to better define the indications found with the visual inspections. Cracks were found in 17 field welds and in two test plate welds. The causes of the cracking are

related to the weld design and installation procedure. Three field welds were rejected because of the depth of the cracks. The NDT inspections, evaluations, method of field metallography, analysis and conclusions are discussed with recommendations for corrective actions in the following report.

## 4206 Safety Engineering

*REFER ALSO TO CITATION(S) 38964*

**39272 (SAND—83-1308C) Consideration of combined-environments effects.** Bonzon, L.L. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-830705—2). NTIS, PC A02/MF A01. Order Number DE83013465.

From IEEE Power Engineering Society summer meeting; Los Angeles, CA, USA (17 Jul 1983).

Equipment Qualification (EQ) is an activity done to demonstrate that safety-related equipment will work when required (in an accident situation). In the 70's the methods used were primarily set by common practice, and certainly less often by any substantial data base. More recent, international, data have introduced synergistic-effects as a parameter that must be addressed. This paper hopes to persuade the nuclear community that this abstraction called synergism can be dealt with by a logical, engineering approach.

## 4208 Electronic Circuits And Devices

*REFER ALSO TO CITATION(S) 38860, 39526*

**39273 (LA—9726-PR) Electronics Division research and development. Progress report, October 1, 1981-September 30, 1982.** MacRoberts, M.D.J.; Newmyer, R.A.; Kruse, N.E. (Los Alamos National Lab., NM (USA)). May 1983. Contract W-7405-ENG-36. 148p. NTIS, PC A07/MF A01. Order Number DE83014067.

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This report, the first in a series of annual reports, describes the status of the research and development activities in the Electronics Division at Los Alamos National Laboratory. Much of the work described is sponsored by the Laboratory; however, other topics are included for completeness. Topics covered in this report are the use of photoconductive semiconductors as fast gates, switches, and detectors; high-temperature, radiation-hardened electronics; growth and characterization of III-V compound semiconductor material for far-infrared detector applications; the use of saturable ferromagnetic elements for high-power, high-repetition-rate switches; the development of a high-power, high-repetition-rate opening switch for use with inductive storage; the implementation of a facility for testing high-power components, initially capacitors, in a high-repetition-rate environment; fast gating and characterization of image intensifier tubes; and the application of ion beam analysis and ellipsometry to the problem of the oxygen reduction reaction at fuel cell electrodes.

**39274 (ORNL/Sub—79-7685/1) Dynamic model for an induction motor and its verification.** Wang, Y.H. (Tennessee Univ., Knoxville (USA). Dept. of Electrical Engineering). Feb 1983. Contract W-7405-ENG-26. 148p. NTIS, PC A07/MF A01. Order Number DE83013738.

This experimental work was conducted to verify a dynamic model of an induction motor in the laboratory environment. A computer was used to generate control signals to change the load torque to the induction motor, and to collect the transient data from the motor in response to load torque changes. The dynamic model of the induction motor chosen for the experiment was a well-known fifth order nonlinear differential model. A derivation of it was presented. The extended Kalman filter was used to estimate the model parameters. The measured data were compared with those predicted by the fifth order model. It was found that the data predicted by the model agreed well with the experimental data.

**39275 (UCID—19816) Robotics research projects report.** Hsia, T.C. (ed.). (Lawrence Livermore National Lab., CA (USA)). Jun 1983. Contract W-7405-ENG-48. 59p. NTIS, PC A04/MF A01. Order Number DE83013619.

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The research results of the Robotics Research Laboratory are summarized. Areas of research include robotic control, a stand-alone vision system for industrial robots, and sensors other than vision that would be useful for image ranging, including ultrasonic and infra-red devices. One particular project involves RHINO, a 6-axis robotic arm that can be manipulated by serial transmission of ASCII command strings to its interfaced controller. (LEW)

**39276 (UCRL—53409-1) Thrust Area: Signal and Control Engineering.** (Lawrence Livermore National Lab., CA (USA)). Oct 1982. Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE83013270.

Within the area of signal and control engineering are three major areas of activity reported: signal processing, image processing, and control systems analysis and design. Most important facilities and technology-base development efforts in each of the three areas and several programmatic examples at Lawrence Livermore National Laboratory are described. (LEW)

**39277 (OA-tr—2528) XLPE-insulated high-voltage cables for rated voltages of 60 and 110 kV.** Peschke, E.F.; Lehrl, H. Translated from *Elektrizitaetswirtschaft ;* **81**: No. 1/2, 34-39(18 Jan 1982). 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83901766.

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Cables with cross-linked polyethylene (XLPE) insulation are being used on an increasing scale even for rated voltages above 60 kV. Production of XLPE-insulated high-voltage cables is based on the data obtained for medium-voltage cables and PE-insulated high-voltage cables. The authors report on their own considerations and investigations into development of dry XLPE high-voltage cables up to 110 kV. They explain the measures to be taken with regard to selection of material, production technology, design and testing.

**39278 Selection of encapsulants for Navy electronic systems.** Lequin, D.S. (U.S. Naval Surface Weapons Center, Silver Spring, MD). pp 380-387 of Technology transfer. Azusa, CA; Society for the Advancement of Material and Process Engineering (1981). (CONF-8110240—).

From 13. national technical conference on technology transfer; Mount Pocono, PA, USA (13 Oct 1981).

A description is presented of some evaluation techniques which can be used as an aid in the selection of liquid casting resins for encapsulation of electronic systems. Tests pertaining to polymerization and tests pertaining to cured properties are considered. The evaluation of encapsulants is discussed, taking into account polymerization properties, cured properties, and changes with long-term storage. The knowledge of the expected service environment for encapsulated electronic systems is critical for the selection of a proper encapsulant.

## 4210 Combustion Systems

*REFER ALSO TO CITATION(S) 38418*

**39279 (CSS/CI—83-20) Liquid-fuel distribution downstream of a swirl atomizer in flowing air.** Chin, J.S.; Myers, G.; Lefebvre, A.H. (Purdue Univ., Lafayette, IN (USA). Combustion Lab. ). Dec 1982. 21p. (CONF-830358—16). Purdue Univ., School of Mechanical Engineering, Thermal Sciences and Propulsion Center, The Combustion Lab., West Lafayette, IN 47907.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

Equations are derived for calculating the radial fuel distribution produced downstream of a pressure-swirl atomizer located in a co-flowing air stream of uniform velocity and temperature. A kerosene-type fuel is selected to illustrate the use of the equations, but the procedure employed is quite general and applies equally well to

any other liquid of known density. Evaporation proceses are neglected, which limits the validity of the method to low air temperatures. The calculated results indicate that the peak values of liquid concentration are reduced by increases in air pressure, spray cone angle, mean drop size and downstream distance. At the same time the position of peak liquid concentration is moved radially outward. It is also observed that the radial penetration of the spray is increased by increase in initial velocity and by reduction in air velocity.

**39280 (DOE/PC/40272—T3) Mechanisms of fouling, slagging, and corrosion by pulverized-coal combustion. Quarterly technical progress report No. 6, 1 January-1 April 1983.** Hsu, L.L.; Stetson, A.R.; Metcalfe, A.G. (Solar Turbines, Inc., San Diego, CA (USA)). May 1983. Contract AC22-81PC40272. 82p. NTIS, PC A05/MF A01. Order Number DE83013132.

A number of interesting phenomena have been identified that are believed to be significant to the understanding of fouling/slagging mechanisms. Fouling of boiler and high-temperature heat exchanger tubes by magnetite ($Fe_3O_4$) was found to be due to oxidation of this compound to $Fe_2O_3$ (hematite) as well as interparticle sintering of $Fe_2O_3$ particles. As deposition of $Fe_2O_3$ proceeds, the underlying oxides are converted to grey-colored defect $Fe_2O_3$ as a result of the lowered oxygen potential in the subscale region. Spheroidization of $Fe_2O_3$ was also observed in the deposit from the 1600°F tube and it is believed that sphere formation could have occurred in the hot gas stream via liquid melt or on the tube surface via solid-state diffusion under the action of surface tension. In a series of experiments using ground glass powder (simulating coal ash), it was found that fouled glass deposits on the 2000°F SiC tube were completely slagged, forming a surface layer of fused glass. At 1600°F tube temperature (and lower) no slagging was observed. Instead, the glass particles had spheroidized (and possibly agglomerated) and these glass spheres were partially fused with adjacent spheres. The fused contact regions between glass spheres were rich in sulfur, sodium and silicon. 36 figures, 12 tables.

### 4230 Marine Engineering

**39281 Underwater operations and techniques.** Paris, France; AIMA (1982). vp. (In French and English). (CONF-821239—). Editions Technip, 27, rue Ginoux, 75 Paris, France.

From International conference on underwater operations and techniques; Paris, France (6 Dec 1982).

Separate abstracts were prepared for 19 papers in this conference proceedings.

### 4240 Pollution Control Equipment

*REFER ALSO TO CITATION(S) 38376, 39377*

### 4250 Power Cycles

**39282 (EPRI-AP—3019) High-temperature ceramic-heat-exchanger development. Final report.** Coombs, M.; Kotchick, D.; Weidhaas, M. (AiResearch Mfg. Co., Torrance, CA (USA)). May 1983. 125p. NTIS, PC A08/MF A01. Order Number DE83902306.

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This report describes the results of a 27-month follow-on effort directed toward developing the technology necessary to build a high-temperature, high-pressure ceramic heat exchanger for operation with a small (200-hp) closed Brayton cycle engine. The ceramic heat exchanger operates with 3000°F combustion products on one side and heats high-pressure argon gas, which subsequently is delivered to a turbine, at 1800°F. The design approach selected for the heat exchanger consisted of an array of siliconized silicon carbide U-tube modules employing 180 1-in.-dia tubes. A preliminary design of the heat exchanger was made that formed the basis for subsequent development effort. An extensive materials data base was obtained for Norton company's NC-430 siliconized silicon carbide during the previous program phase. This data was augmented during this program phase with over 200 additional basic materials tests. The materials test program encompassed strength tests, cyclic fatigue tests, and stress rupture tests at 2300°F. Strength data compiled in the form of Weibull plots for application to design efforts. Slow crack growth was not observed in NC-430 at 2300°F. Materials specimens, subscale heat exchanger components, and a subscale heat exchanger module were designed and built for the testing effort. Various tests were conducted on the subscale ceramic heat exchanger components to develop a feasible full-scale, high-temperature, high-pressure sealing concept to allow modular construction of large ceramic heat exchangers. A high-pressure, high-temperature seal of glass encapsulated carbon was successfully designed and tested to 1800°F and 150 psia. A complete heat exchanger module was produced and tested under simulated engine operating conditions up to 2300°F tube wall temperatures. This test was designed to demonstrate the design technique and to test the reliability predictions for the various ceramic components.

## 43 PARTICLE ACCELERATORS

### 4301 Design, Development, And Operation

*REFER ALSO TO CITATION(S) 39854*

### 4302 Beam Dynamics, Field Calculations, And Ion Optics

**39283 (DOE/ER/05940—001) Study of instabilities and emittance growth in periodic focusing systems for intense beams. Technical report No. PP 82-142. Progress report.** Reiser, M. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Mar 1982. Contract AS05-78ER05940. 14p. NTIS, PC A02/MF A01. Order Number DE83012787.

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Experimental studies of beam properties and nonlinear effects with one and two solenoid lenses have yielded a large amount of valuable data. Several phenomena were identified and explored such as images and halos and formation of pronounced hollow beam profiles after passage through the lenses. The hollow beam effect is qualitatively attributed to nonlinear space charge forces and lens aberrations. The main research effort during the past year was devoted to the experimental investigation of beam focusing with one and two solenoid lenses.

**39284 (IFVE-ONF—81-98) Calculation of tagged neutrino beams for ASF.** Denisov, S.P.; Zhigunov, V.P.; Mukhin, S.A.; Spiridonov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701952.

Paper copy only, copy does not permit microfiche production refs.; 11 figs.; 8 tabs.

The characteristics of the tagged muon and electron neutrino beams have been calculated. The decays Ksup(+-)→μsup(+-)νsub(μ) and Ksup(+-)→Esup(+-)νsub(e)πsup(0) of 1-2 TeV/c kaons were chosen as a neutrino source. The tagged neutrino energy resolution σ(Esub(ν))/Esub(ν) is about 3%. The angular resolution σ(THETAsub(ν)) is about 7 μ rad for νsub(μ) and 5 μ rad for νsub(e). The background level does not exceed 1-2%. The comparison with the dichromatic muon neutrino beam is presented.

**39285 (Juel-Spez—159) Workshop on electron cooling.** Berg, G.P.A.; Huerlimann, W.; Roemer, J.G.M. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Jul 1982. 276p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

From Workshop on electron cooling; Bad Honnef (Germany, F.R.) (27 - 28 May 1982).

These proceedings contain the copies of the transparencies discussions, and in some cases the manuscripts for the speeches held at the named workshop. These speeches concern first ideas about a

Cooler-synchrotron at Juelich, a review of the principles of electron cooling, the need for small cross section measurements at medium energies, the description of the Indiana storage ring with electron-cooling, electron cooling in combination with internal targets, the feasibility of a recirculator for the BIG KARL spectrograph, the challenge of physics with a high-energy light-ion facility, the acceleration and storage of polarized particle beams, the antiproton accumulators at FERMILAB and recent results of electron-cooling, and the description of SIS 12 as a look to the possibilities of electron-cooling of heavy ions.

## 4303 Auxiliaries And Components

*REFER ALSO TO CITATION(S) 39232, 39284, 39302, 39659*

**39286 (AERE-MPD/NBS—205) Our latest neutron source. How the new Harwell linac (HELIOS) opens up the field of neutron scattering from solids and liquids.** Windsor, C.; Sinclair, R. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). Jul 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701690.

An outline is given of the history of neutron scattering showing that while reactors are suitable for thermal or long wavelength neutrons, pulsed neutron sources become increasingly efficient as the neutron wavelength is reduced. A description of Helios - the new Harwell linac providing a facility for 'hot'-neutron scattering is presented and the types of new work for which it is hoped Helios will be used are suggested.

**39287 (CONF-830576—1) Data-acquisition software for the Holifield Heavy Ion Research Facility.** Atkins, W.H. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE83012584.

From Real-time computer applications in nuclear and particle physics conference; Berkeley, CA, USA (16 May 1983).

A new computer system to perform data acquisition and analysis for the Holifield Heavey Ion Research Facility's Oak Ridge Isochronous Cyclotron (ORIC) and the newer 25-MV tandem accelerator has been under development. This paper presents the current implementation and discusses the design of the data-acquisition/analysis software.

**39288 (DOE/ER/10699—T2) Status of P714 - LAPDOG.** Ahrens, L.; Aronson, S.; Connolly, P. (State Univ. of New York, Stony Brook (USA)). 1 Feb 1983. Contract AC02-80ER10699. 36p. NTIS, PC A03/MF A01. Order Number DE83013613.

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This document summarizes the present status of LAPDOG (P714) including discussions of the physics motivations, detector development, Monte Carlo studies and overall perspectives of the experiment. LAPDOG was conceived as a high resolution electromagnetic detector for ISAbelle. With the opening of the DO area at Fermilab, a revised experiment, optimized to take account of the lower luminosity but earlier time scale, was submitted to the PAC in February 1981. Since the the original proposal, we have submitted eleven additional notes, which describe the results of background studies, prototype detector performance, and anticipated physics results. These submissions have been the fruit of continuous work on improving and refining the experiment. This summer we held a week-long workshop of collaborators, theorists and visitors, which reinforced our belief that LAPDOG is still an exciting and timely experiment which can contribute fundamental physics results to the Collider program.

**39289 (INFN/TC—82/10) Magnetic forces on the coils of the superconducting cyclotron at the University of Milan.** Fabrici, E. (Milan Univ. (Italy); Istituto Nazionale di Fisica Nucleare, Milan (Italy)). 19 Jul 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83902400.

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The calculation of the attractive forces between the coils have given a maximum force of 1576 Tons for the case of J/sub $\alpha$/ = J/sub $\beta$/ = 3500 A/cm$^2$ corresponding to an average pressure of 153 Kg/cm$^2$ exerted by each coil, above and below the median plane, on the central ring of the cryostat. The repulsive forces between the $\alpha$ and $\beta$ sections of the coils are around 600 Tons for the case J/sub $\alpha$/ = 3000, J/sub $\beta$/ = -1500 A/cm$^2$, chosen as the more critical one for the ac celebration of ions with Z/A $\leqq$ 0.5. From a crude interpolation between the results obtained for the cases J/sub $\alpha$/ = 3000 A/cm$^2$ with J/sub $\beta$/ = -1500 and -2500 A/cm$^2$ the repulsive forces at the coils excitations necessary to accelerate the $^3He^{++}$ beams will be less than 850 Tons.

**39290 (LA-UR—83-1466) Developing a 500-eV proton beam.** Chamberlin, E.P.; Benage, J.F. Jr.; Williams, H.E. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 13p. (CONF-830591—1). NTIS, PC A02/MF A01. Order Number DE83012781.

From Polarized ion workshop; Vancouver, Canada (23 May 1983).

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Tests have been carried out which indicate that H- intensity limitations in lamb-shift polarized ion sources result from large diveregence in the 500-eV H+ ion beam. Intensity limitations due to other effects are not yet measurable.

**39291 (SLAC-PUB—3072) On-line control models for the Stanford Linear Collider.** Sheppard, J.C.; Helm, R.H.; Lee, M.J.; Woodley, M.D. (Stanford Linear Accelerator Center, CA (USA)). Mar 1983. Contract AC03-76SF00515. 3p. (CONF-830311—172). NTIS, PC A02/MF A01. Order Number DE83013126.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

Models for computer control of the SLAC three-kilometer linear accelerator and damping rings have been developed as part of the control system for the Stanford Linear Collider. Some of these models have been tested experimentally and implemented in the control program for routine linac operations. This paper will describe the development and implementation of these models, as well as some of the operational results.

**39292 (SLAC-PUB—3078) Application of local area networks to accelerator control systems at the Stanford Linear Accelerator.** Fox, J.D.; Linstadt, E.; Melen, R. (Stanford Linear Accelerator Center, CA (USA)). Mar 1983. Contract AC03-76SF00515. 4p. (CONF-830311—170). NTIS, PC A02/MF A01. Order Number DE83013106.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

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The history and current status of SLAC's SDLC networks for distributed accelerator control systems are discussed. These local area networks have been used for instrumentation and control of the linear accelerator. Network topologies, protocols, physical links, and logical interconnections are discussed for specific applications in distributed data acquisition and control system, computer networks and accelerator operations.

**39293 (SLAC-PUB—3085) Update on the high-current injector for the Stanford Linear collider.** James, M.B.; Clendenin, J.E.; Ecklund, S.D.; Miller, R.H.; Sheppard, J.C.; Sinclair, C.K.; Sodja, J. (Stanford Linear Accelerator Center, CA (USA)). Mar 1983. Contract AC03-76SF00515. 4p. (CONF-830311—169). NTIS, PC A02/MF A01. Order Number DE83013107.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

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The high current injector has become operational. There are two crucial areas where improvements must be made to meet collider specifications: while the injector can produce up to $10^{11}$ $e^-$ in a single S-band bucket, initially much of this charge was captured in a low energy tail and was this not suitable for transport through the accelerator and injection into the damping ring. Pulse to pulse position jitter has been observed, resulting in transverse wake field which increases beam emittance. The problems described above contribute to substantial current loss during transport from the injector (40 MeV) to the SLC damping ring (1.2 GeV). Experimental

studies are continuing with the aim of understanding and improving beam characteristics including bunch length, pulse to pulse stability and emittance. The present status of these studies is reported.

39294 **(CAPE—2831) SLAC penetration waveguide assembly AD-767-301-00-R3.** (Stanford Linear Accelerator Center, CA (USA)). 26 Jun 1983. Contract AC03-76SF00515. USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830.

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The Assembly Drawing AD-767-301-00-R3 and related and referenced drawings provide the information and specifications for construction of a typical SLAC 463.5 in. penetration vacuum waveguide. This assembly is used to conduct rf power from the Klystron Amplifiers in the Klystron Gallery down to the accelerator sections in the Accelerator flowing approximately 30 ft below the Gallery floor. This item is used with other waveguide components such as elbows, Crossbars and Pumpouts. Approximately 500 of these assemblies were used on the Stanford Two-Mile Linear Accelerator.

39295 **FASTBUS active segment extender and high density prototyping (KLUGE) card.** Haynes, B.W.; Bays, L.A.; Machen, D.R. (Fermi National Accelerator Laboratory, Batavia, IL 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 1, 212-215(Feb 1983).

This paper describes in brief, an active segment extender and a high density prototyping (kluge) card for use in the development of FASTBUS modules. The Active Extender is a diagnostic tool which extends and buffers the FASTBUS ECL backplane signals to the front of a crate. The prototyping (kluge) card is a double-sided, high density wire wrap printed circuit board with over-voltage and over-current protection to be used for FASTBUS module prototypes and a power/ground plane for use in the Multiwire process for the finalized design.

39296 **Standard software routines for FASTBUS and their implementation for a PDP-11 RT-11 system, using the UNIBUS processor interface.** Pordes, R. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 1, 186-187(Feb 1983).

This paper describes the standard software routines for FASTBUS, published by the FASTBUS Software Working Group in conjunction with the FASTBUS Specification. It discusses their implementation for a PDP-11 RT-11 system, and their use with the Fermilab Data Acquisition system MULTI in a high energy physics experiment at Fermilab.

39297 **Data collection from FASTBUS to a PDP-11 through the UNIBUS-processor interface.** Larwill, M.; Barsotti, E.; Lesny, D.; Pordes, R. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 1, 191-192(Feb 1983).

This paper describes the use of the UNIBUS Processor Interface, an interface between FASTBUS and the PDP-11 UNIBUS developed by Fermilab and the University of Illinois. Details of how this interface was used in a high energy physics experiment at Fermi National Accelerator Laboratory are given.

39298 **(CAPE—2828) SLAC Klystron Gallery Crossbar (specifically hybrid coupler power divider) (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). [nd]. Contract AC03-76SF00515. USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830.

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Drawing list DL-767-306-00-R1 and the drawings listed thereon provide the information and specifications for constructing a typical SLAC Klystron Gallery Crossbar which incorporates a typical Hybrid 3 dB waveguide coupler. The hybrid coupler and crossbar provide a equal power distribution system from one Klystron output to two inputs for distribution to two more 3 dB Hybrid couplers and subsequently to 4 accelerator sections in the accelerator housing. Each coupler splits the power equally resulting in 1/4 of the klystron's output going to each of 4 accelerator sections. DL-767-315-00-R0 is presently superceded by DL-767-436-07-R2. DL-767-435-07-R2 is part of the recent SLED modification of the accelerator. The hybrid coupler is used on the waveguide connecting the klystron, the SLED cavities and the accelerator waveguide system. The earlier standard model is included for completeness.

39299 **(CAPE—2830) SLAC 10 ft accelerator section support structure.** (Stanford Linear Accelerator Center, CA (USA)). [nd]. Contract AC03-76SF00515. USDOE-TIC, PO Bx 62, Oak Ridge, TN 37830.

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Assembly Drawing AD-756-082-00-R0 and the referenced drawings and specifications on the series of drawings provide the information and specifications for constructing a typical support structure for a typical SLAC 10 ft. disc loaded waveguide accelerator section. This support assembly is supported in turn by a 2 ft. dia. 40 ft. long aluminum girder and then from the floor by wormscrew jacks. SLAC contains approximately 960 of these typical support assemblies in its accelerator housing. Jacks and 2 ft. girder and accelerator section drawings are not included in this group.

## 4304 Storage Rings

*REFER ALSO TO CITATION(S) 39547*

39300 **(DESY—82-076) Compensation of the depolarizing effects of solenoids in electron-positron storage rings.** Barber, D.P.; Kewisch, J.; Mais, H.; Ripken, G.; Rossmanith, R.; Schmidt, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750670.

We show how solenoids lead to loss of vertical polarization in electron-positron storage rings and propose a general prescription for compensating depolarizing effects with the aid of additional opposite polarity 'antisolenoids' which need not necessarily be placed next to the main solenoid but may be placed in positions where x' of the particle trajectory is similar to the x' at the interaction point. We also discuss the implications for the achievement of longitudinal polarization.

39301 **(DOE/ER/40033—38) CBA special detectors: diffraction dissociation and heavy-quark production.** Sticker, H. (Rockefeller Univ., New York (USA)). 1983. Contract AC02-81ER40033. 15p. NTIS, PC A02/MF A01. Order Number DE83012981.

Two different but related experiments that would benefit from specialized detectors are measurements of diffraction dissociation and search for heavy quark production in the forward direction. At the CBA masses up to M/sub x/ $\simeq 0.3\sqrt{s} \sim = 240$ GeV can be produced coherently. The production of these states is of interest in itself and as a possible mechanism for copious production of new heavy flavors. In both cases, the required detectors are different from and more modest than the large central detectors. The required detectors are discussed.

39302 **(LBL—14773) New wiggler beam line for SSRL.** Hoyer, E. (Lawrence Berkeley Lab., CA (USA)). Aug 1982. Contract AC03-76SF00098. 25p. (CONF-820839—8). NTIS, PC A02/MF A01. Order Number DE83012914.

From International conference on X-ray and VUV synchrotron radiation instrumentation; Hamburg, F.R. Germany (9 Aug 1982).

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A new high-intensity-beam line with a wiggler magnet source is described. This project, in final stages of design, is a joint effort between Lawrence Berkeley Laboratory (LBL), the Exxon Research and Engineering Company (EXXON), and the Stanford Synchrotron Radiation Laboratory (SSRL). Installation at SSRL will begin in the summer of 1982. The goal of this project is to provide extremely high-brightness synchrotron radiation beams over a

broad spectral range from 50 eV to 40 keV. The radiation source is a 27 period (i.e., 55 pole) permanent magnet wiggler of a new design. The wiggler utilizes rare-earth cobalt (REC) material in the steel hybrid configuration to achieve high magnetic fields with short periods. An analysis has been made of the polarization, angular distribution and power density of the radiation produced by the wiggler. Details of the wiggler design are presented. The magnet is outside a thin walled (1mm) variable gap stainless steel vacuum chamber. The chamber gap will be opened to 1.8 cm for beam injection into SPEAR and then closed to 1.0 cm (or less) for operation. Five remotely controlled drives are provided; to change the wiggler gap, to change the vacuum chamber aperture and to position the wiggler. Details of the beam line optics and end stations are presented. Thermal loading on beam line components is severe. The peak power density at 7.5 m is 5 kW/cm$^2$ for the nominal wiggler field and present SPEAR beam currents and will approach 20 kW/cm$^2$ with the maximum wiggler field and projected SPEAR beam currents.

39303 **Heat load measurement of prototype cryogenic magnets and leads for the Isabelle project.** Werner, A.P.; Brown, D.P.; Schneider, W.J. (Brookhaven National Lab., Upton, NY). pp 517-524 of Advances in Cyrogenic Engineering, Vol. 27. Fast, R.W. New York, NY; Plenum (1982). (CONF-810835—).

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The prototype cryogenic magnets for ISABELLE are introduced in terms of heat load measurements and leads. A description of the test bed is given with a schematic drawings. Test results are given with dipole magnet at 4 K and 55 K heat loads. The ISABELLE dipole magnet cross-section is illustrated and load allowance shown in table form. Magnet power leads are described with primary and secondary vessel heat load measurements shown. Comments include a presentation of the thermal performance of a single 4250 A power lead and a 12 x 100 A power lead bundle.

# 44 INSTRUMENTATION

## 4401 Radiation Instrumentation

*REFER ALSO TO CITATION(S) 38545, 38573, 39147, 39218, 39288, 39301, 39547, 39734*

39304 **(DOE/ER/10699—T1) Response of a highly segmented extruded lead glass calorimeter to electrons and pions between 15 and 45 GeV/c.** Engelmann, R.; Godfrey, L.; Grannis, P.D. (State Univ. of New York, Stony Brook (USA)). 1983. Contract AC02-80ER10699. 47p. NTIS, PC A03/MF A01. Order Number DE83012986.

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We have studied the energy resolution, hadron rejection and ability to distinguish overlapped events for a highly segmented electromagnetic calorimeter using unpolished extruded lead glass bars. Energy resolution is in agreement with previous measurements of more conventional calorimeters. Hadron rejections of $10^{-3}$ are achieved, without the use of particle momentum information. Overlapped events of $\pi^{+-}$-$\gamma$ are shown to be rejected at the level of $10^{-2}$. A powerful method for predicting shower leakage energy is also presented.

39305 **(DP—1654) Nondestructive assay of uranium enrichment with gamma rays.** Winn, W.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Mar 1983. Contract AC09-76SR00001. 20p. NTIS, PC A02/MF A01. Order Number DE83013423.

An instrument has been developed and tested for nondestructive assay of $^{235}$U enrichment of uranium oxide powder contained in sealed 1-gallon cans. Enrichment ($\epsilon$) is measured from the count rate (D) of the 186 keV $\gamma$-ray of $^{235}$U, using an HPGe $\gamma$-detector. A theoretical correlation of $\epsilon$ vs D agrees well with the calibration measurements and provides guidelines for applicability. Measurements for 97 can samples with $\epsilon$ = 56 to 60 enrichment percent (e%) $^{235}$U demonstrated accuracy of ~ 0.2 e% $^{235}$U and precision of ~ 0.4 e% $^{235}$U, with 10-minute count times. A microcomputer simplifies operator requirements and provides on-line enrichment results.

39306 **(LA-UR—83-1548) High-Z organic-scintillation solution.** Berlman, I.B.; Fluornoy, J.M.; Ashford, C.B.; Lyons, P.B. (EG and G, Inc., Goleta, CA (USA); Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 11p. (CONF-830565—2). NTIS, PC A02/MF A01. Order Number DE83012774.

From Advances in scintillator counting conference; Banff, Alberta, Canada (15 May 1983).

In the present experiment, an attempt is made to raise the average Z of a scintillation solution with as little attendant quenching as possible. Since high-Z atoms quench by means of a close encounter, such encounters are minimized by the use of alkyl groups substituted on the solvent, solute, and heavy atoms. The aromatic compound 1,2,4-trimethylbenzene (pseudocumene) is used as the solvent; 4,4"-di(5-tridecyl)-p-terphenyl (SC-180) as the solute; and tetrabutyltin as the high-Z material. To establish the validity of our ideas, various experiments have been performed with less protected solvents, and heavy atoms. These include benzene, toluene, p-terphenyl, bromobutane, and bromobenzene.

39307 **(LBL—14459) Liquid-helium scintillation detection with germanium photodiodes.** Luke, P.N.; Haller, E.E.; Steiner, H.M. (Lawrence Berkeley Lab., CA (USA)). May 1982. Contract AC03-76SF00098. 5p. (CONF-821011—51). NTIS, PC A02/MF A01. Order Number DE83013510.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

Special high-purity germanium photodiodes have been developed for the direct detection of vacuum ultraviolet scintillations in liquid helium. The photodiodes are immersed in the liquid helium, and scintillations are detected through one of the bare sides of the photodiodes. Test results with scintillation photons produced by 5.3-MeV $\alpha$ particles are presented. The use of these photodiodes as liquid-helium scintillation detectors may offer substantial improvements over the alternate detection method requiring the use of wavelength shifters and photomultiplier tubes.

39308 **(MLM—3065(OP)) Experiences with three tube phoswich detectors.** Tomlinson, F.K. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 26p. (CONF-830557—2). NTIS, PC A03/MF A01. Order Number DE83011792.

From ORNL workshop on calibration of actinide lung counters; Oak Ridge, TN, USA (10 May 1983).

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Two phoswich detectors, each having three photomultiplier tubes, have been developed and used in routine lung counting at Mound since 1979. Our experiences during the development and with the use of this detector system are described. Details of the detectors and associated instrumentation are also included. The detector system described has proved to be more sensitive over time than the previous single tube phoswich system; however, the instrumentation is more difficult to set up and maintain.

39309 **(Y/DW—435) LLNL realistic phantom characteristics using coaxial n-type germanium detectors.** Sheppard, G.A. (Oak Ridge Y-12 Plant, TN (USA)). 9 May 1983. Contract W-7405-ENG-26. 14p. (CONF-830557—4). NTIS, PC A02/MF A01. Order Number DE83011855.

From ORNL workshop on calibration of actinide lung counters; Oak Ridge, TN, USA (10 May 1983).

Closed-end coaxial n-type germanium detectors have been evaluated as an alternative to NaI(Tl) detectors for in vivo uranium lung burden analysis. Using anthropomorphic phantom torsos for study, detection limits have been established, sensitivity curves have been derived, the effects of chest wall thickness and composition have been measured, and optimal detector placement has been determined.

**39310 Identificaton of GeV electrons via particle multiplicity in a silicon detector: measurement and EGS simulation.** Heijne, E.; Jarron, P. (European Organization for Nuclear Research, Geneva (Switzerland)); Jenkins, T.; Nelson, W.R. (Stanford Linear Accelerator Center, CA (USA)); Ing, H. (Atomic Energy of Canada Ltd., Chalk River, Ontario). *Nuclear Instruments and Methods in Physics Research;* **205**: No. 3, 437-442(1 Feb 1983).

The measurement of particle multiplicity in a silicon detector can be used to discriminate electrons in a flux of high energy particles. Monte Carlo simulations are compared with measurements at 4 and 15 GeV/c, for electrons and pions. With a 7 mm lead converter 80% of the electrons produce a signal higher than two minimum ionizing particles in a 63 $mm^2$ silicon detector.

**39311 High energy electromagnetic shower position measurement by a fine grained scintillation hodoscope.** Cox, B.; Areti, H.; Conetti, S.; Hale, G.; Lebrun, P.; Mazur, P.O.; Wagner, R.L.; Wagoner, D.E. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 1, 131-133(Feb 1983).

The authors have measured the centroids of high energy electromagnetic showers initiated by positrons in the energy range 2 to 17.5 GeV with a fine grained scintillation hodoscope composed of seven 1 cm wide elements placed behind a 3.6 radiation length (15 cm) converter composed of SCG1-C scintillation glass. A simple first moment calculation using the ionization observed in each element of this hodoscope yields a shower position resolution as a function of energy of: $\sigma(mm) = 0.7 + 5.6/E(GeV)$. They present results on the energy dependence of the shower profiles and the ionization measured by this hodoscope.

**39312 Development and performance of a calibration system for a large calorimeter array.** Arenton, M.; Cormell, L.; Dawson, J.; Ditzler, W.R.; Fleischman, J.; Harrison, M.; Johns, K.A.; Schlereth, J. (Argonne National Laboratory, Argonne, IL 60439). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 1, 193-197(Feb 1983).

Experiment 609 at Fermilab is a study of the properties of high-p /SUB t/ collisions using a large segmented hadron calorimeter. The calibration and monitoring of such a large calorimeter array is a difficult undertaking. This paper describes the systems developed by E609 for automatic monitoring of the phototube gains and performance of the associated electronics.

**39313 Parallel processor for the spin spectrometer.** Hensley, D.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **30**: No. 1, 198-201(Feb 1983).

Current maximum data rates from the Spin Spectrometer of about 5000 events/s (up to 1.3 MBytes/s) and minimum analysis requiring at least 3000 operations/event require a CPU cycle time near 70 ns. In order to achieve an effective cycle time of 70 ns, a parallel processing device is proposed. Up to 4 independent processors will be implemented in parallel in a quasi-CAMAC environment. The individual processors are designed around the Am2910 Microsequencer, the AM29116 μP, and the Am29517 Multiplier. Satellite histogramming will be handled by a commercial 16-bit μP system.

## 4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

*REFER ALSO TO CITATION(S) 38629*

**39314 (AD-A—124125/6) Total dose and transient radiation testing of two CMOS/SOS RAM's.** Self, C.T. (Harry Diamond Labs., Washington, DC (USA)). Dec 1982. 7p. (HDL-TR—82-1). Harry Diamond Lab., Attn: HD-NW-RH, 2800 Powder Mill Road, Adelphi, MD 20783.

Total dose and transient radiation measurements were performed in situ on two complementary metal-oxide semiconductor/silicon on sapphire (CMOS/SOS) random-access memories (RAM's). Total-dose failure levels were determined using a Co 60 isotope source. Upset levels were determined at both a flash x-ray facility and a linear accelerator. The two RAM's are configured as 256 x 4 and 1k x 1 and are equivalent to types 6551 and 6518, respectively.

**39315 (ITEF—117(1981)) Study of elimination of defects induced by heavy nuclei fission fragments in thin near-surface layers of mica.** Gorshkov, V.K.; Nechushkin, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701906.

In the experiments with mica (muscovite) irradiated with heavy nuclei fission fragments, the minimum chemical etching time $tau_0$ was measured after which fission-fragment-created tracks are etched and become visible in an optical microscope. It is established that $tau_0$ depends on the fragment +ncident angle THETA and energy E and on the annealing temperature T of the irradiated samples. $Tau_0$ increases with THETA and T and decreases with E. The regularities of $tau_0$(THETA, T, E) imply that at normal ambient pressure the elimination of defects created by fission fragments occurs with a higher rate in a near-surface layer approximately 0.1 μk thick than in a volume.

## 4403 Miscellaneous Instruments

*REFER ALSO TO CITATION(S) 39267, 39275*

**39316 (EGG—10282-1018) Soil-pore gas-pressure measurements at the Nevada Test Site.** Davies, L.; Noyes, R.; Kalinowski, J.; Stubbs, T. (EG and G, Inc., Las Vegas, NV (USA); EG and G, Inc., San Ramon, CA (USA)). 1983. Contract AC08-83NV10282. 18p. (CONF-830639—3). NTIS, PC A02/MF A01. Order Number DE83012750.

From 12. transducer workshop; Melbourne, FL, USA (7 Jun 1983).

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This paper describes a system that monitors soil-pore pressure in dry reconstituted soil, serving as the tamping and containing medium for experimental explosions. This system has proven to be reliable and stable over the several years that it has been maintained and operated. It yields information on compresion of the soil due to the initial shock wave, rarefactions due to settling and variations that correlate well with variations in atmospheric pressure. The burial depth of sensing systems ranges from a few feet to over 1000 feet in alluvium-like material. The primary sensing device is a pressure transducer in a protective structure sometimes referred to as a cowbell or a rocket. The why, when, and where of the measurements is given along with the system calibration, instrument installation, recording, and data reduction. Examples of data and their analysis are presented.

**39317 (LBL-PUB—3033) SPEC-DOC: a user's guide to spectrometer software.** Sinton, S.; Garbow, J.R.; Ackerman, J.L.; Drobny, G.; Ruben, D.J.; Pines, A. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 128p. NTIS, PC A07/MF A01. Order Number DE83013295.

SPEC is the name of the operating system designed to control NMR spectrometers. SPEC is actually one large program which handles many functions necessary to control each spectrometer. The SPEC operating system is documented. The general operation of SPEC is discussed, including how to get into the program and how to issue commands. The commands are discussed in detail, as well as the operation of the microprocessor based pulse programmer, spectrometer peripherals, supporting programs, and how to create and load a TEMP program. Appended are details on bootstrapping procedures, hardware specifics, a technical description of SPEC and how to change or recreate it, a description of microcode loading and the procedure for formatting floppies, disks, and recreating RDOS. (LEW)

**39318 (SAND—79-2198) Alternate approach for terrain-aided navigation using parallel extended Kalman filters.** Sheives, T.C.; Andreas, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1979. Contract AC04-76DP00789. 16p. NTIS, PC A02/MF A01. Order Number DE83013645.

A new approach for applying SITAN (Sandia Inertial Terrain Aided Navigation) to applications involving large initial position errors is described and analyzed. The approach uses parallel Kalman filters in combination with a selection algorithm to estimate the errors in the reference navigation system. Monte Carlo simulation and covariance analysis results are presented which demonstrate the feasibility and practicality of the approach.

**39319 (SAND—82-1730C) Systems approach to measuring short-duration acceleration transients.** Schelby, F. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 29p. (CONF-830639—1). NTIS, PC A03/MF A01. Order Number DE83011499.

From 12. transducer workshop; Melbourne, FL, USA (7 Jun 1983).

A shock measurement system has been developed in which the quartz seismic system, two-pole active filter and an FET source follower are incorporated in a transducer housing measuring 5/16" hex.x 5/8". Tests have shown that the system will survive +- 100,000g without damage. Although the results reported here are for accelerometers ranged to +- 20,000g, there is no reason to limit the accelerometers to that range and PCB can supply different ranges as required. The PCB Model 305M23, developed to Sandia's specifications, has proved capable of obtaining data comparable to that of standard piezoelectric and piezoresistive accelerometers when high frequencies are absent. In the presence of high frequency stimuli, the accelerometer has obtained data without over-ranging its data channel and without introducing error signals from excitation of the resonant frequency of its seismic system. It should, therefore, be especially useful for impact and pyrotechnic measurements. These shock accelerometers are in the process of being fielded in earth penetrator vehicles; in shale rubblization experiments will soon be available. It appears this joint development effort and test program has greatly enhanced the probability of acquiring successful structural measurements in harsh mechanical loading environments.

**39320 (SAND—82-1877C) Drift prediction for a roll-stabilized inertial measurement system.** Bateman, V.I. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 28p. (CONF-830639—4). NTIS, PC A03/MF A01. Order Number DE83012635.

From 12. transducer workshop; Melbourne, FL, USA (7 Jun 1983).

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A roll-stabilized inertial measurement system is being developed by Sandia National Laboratories. This system will measure three orthogonal-body angular rates and three orthogonal-body accelerations and will calculate three Euler angles for attitude control of small rocket systems and/or large rocket payloads in flight. An analysis of the predicted drift in the Euler angles has been undertaken to aid in the definition of computational hardware characteristics (such as gyro resolution and gyro sample frequency) and to assess the performance of the system over typical trajectories. The method of analysis uses two different techniques to calculate Euler angles and to compare the results. The first technique results in a true Euler angle which is calculated by a Bortz equation (a method to relate vehicle body coordinates to earth coordinates). The second technique simulates the in-flight calculations by including effects of drift from the truncated Bortz algorithm, quantization, and random gyro drift. The comparison results in drift as a function of time for the three Euler angles, roll, pitch, and yaw. Examples of predicted drift over typical trajectories are presented.

**39321 (SAND—83-0197) Design, performance, and operation of the laser interferometric dilatometer.** Drotning, W.D. (Sandia National Labs., Albuquerque, NM (USA)). May 1983. Contract AC04-76DP00789. 109p. NTIS, PC A06/MF A01. Order Number DE83014359.

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A dilatometer was designed and constructed to perform high-precision thermal-expansion measurements over the temperature range from ambient to 900 K. This report details the design, construction, operation, and performance of the device. The measurement of length change employs an optical interferometer system which consists of a Michelson interferometer, a two-frequency HeNe laser, and ac fringe detection. Length-change precision of better than +- 0.05 $\mu$m is achieved. Dilatometer control, status, data acquisition, and analysis functions are achieved by a minicomputer in order to achieve automated control. Further design features are incorporated which minimize sample preparation and assembly time to achieve rapid sample measurements. The interferometer alignment is under computer control to assist the operator during final adjustment and to maintain alignment throughout the course of a measurement. The performancee of the device was evaluated by measurement of three thermal-expansion standards (fused silica, platinum, and copper). For the low-expansion fused silica, the dilatometer was determined to have a precision of 3 x $10^{-9}$/K in the measurement of the thermal-expansion coefficient. Two additional applications of the device are described to demonstrate its use on thin (3-mm) samples and for long-term length changes under isothermal conditions.

**39322 (SAND—83-8232) Precision differential digitizer.** Van Hook, A. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1983. Contract AC04-76DP00789. 69p. NTIS, PC A04/MF A01. Order Number DE83013864.

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We have developed a high-dynamic-range, state-of-the-art, differential digitizer and used it in coherent anti-Stokes Raman spectroscopy and spontaneous Raman spectroscopy experiments. The digitizer is a high-speed device used to extract small signal pulses from large background-noise levels. It has total internal noise of less than 200 $\mu$V to 10 V in amplitude and from $\sim$ 30 to 500 ns wide, can be acquired. The gate window, for differential subtraction, can be varied by front-panel control from 50 to 500 ns. A five-digit display shows the digital word being presented to the computer interface, which represents the corrected pulse height. The testing procedures and the design criteria are presented. The setup procedures, with complete FORTRAN programs, are given for individual digitizer analysis.

**39323 (UCRL—50025-83-1) EE technical review.** (Lawrence Livermore National Lab., CA (USA)). Apr 1983. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01. Order Number DE83014486.

Electronic engineering work in three areas is summarized. The upgrading of a nuclear chemistry counting facility to do automatic radiometric assay of many diverse samples is reported. A three-wavelength scanning photometer for large optical parts is discussed, followed by a measuring system equipped with a voice to announce on demand the measurement registered by a gage. (LEW)

**39324 International Symposium on Remote Sensing of Environment, 15th, University of Michigan, Ann Arbor, MI, May 11-15, 1981, Proceedings. Volumes 1, 2 and 3.** Ann Arbor, MI; Environmental Research Institute of Michigan (1981). 570, 568, 493p. (CONF-810557—).

From International symposium of remote sensing of environment; Ann Arbor, MI, USA (11 May 1981).

Developments related to advanced sensors and sensor systems are being examined, taking into account advanced aerospace remote sensing systems for global resource applications, spaceborne radar observation of the earth surface, a concept for an advanced earth resources satellite system, technologies for the multispectral mapping of earth resources, and the use of Landsat images and morphologic analogs in space exploration. Other topics discussed are related to modeling for terrain analysis, digital processing and analysis of remotely sensed data, microwave remote sensing, new discoveries from planetary remote sensing, and data base utilization. Advances in the area of luminescence are also considered along with future plans and prospects concerning the remote sensing of the earth from space.

**39325 A high precision 2D signal analysis, performed coherent optically as a preceding step in picture deblurring.** Platzer, H.; Gluender, H. (Muenchen, Technische Universitaet, Munich, West Germany). pp 66-75 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

It is noted that in order to restore a blurred and noisy image, a filter must be constructed, requiring estimates of the blurring function and the S/N ratio. A procedure is elaborated which gives S/N estimates for practical cases. The signal analysis is performed using coherent optics with very high precision. It uses the information contained in the power spectra of the relevant image details. Special attention is given to the practical solution of this analysis, with actual data used for illustration. Such topics as window functions, gamma-correction, scanning devices and special optical setups are treated in detail.

**39326 A new type of holo-camera.** Rowley, D.M. (Loughborough Univ. of Tech., Leics., England). pp 117-126 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

It is noted that the broader applications of holographic interferometry are often restricted by the inconvenience of the technique. Other limiting factors are the requirement for antivibration mounts, blackout conditions, high power expensive lasers and photographic plates costing more than $2.00 per exposure. Built around a standard 35-mm reflex camera, the holo-camera described here uses the principles of common path interferometry and white light holography to circumvent some of these difficulties. The use of the camera to identify the isotherms in convective heat transfer is described, and the results are compared with those of other investigators.

**39327 A review of laser systems in flow measurement.** Greated, C.A. (Edinburgh, Univ., Scotland). pp 210-216 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

The development of Doppler and two-beam velocity measuring systems is reviewed together with their practical applications. Time averaged spectral and correlation techniques are discussed, and it is shown that as well as being useful for the estimation of flow characteristics, such as mean velocity and turbulence level, they can also be used to determine higher order statistics. The theory of frequency tracking is outlined using a simplified approach. Finally, examples are given from some laboratory studies of oscillatory flows.

**39328 Gated sampling with a simple periodicity applied to the photon correlation technique.** Grant, I. (Heriot-Watt Univ., Edinburgh, Scotland). pp 217-222 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

The photon correlation technique in laser-anemometry has recently been extended to the measurement of unsteady and oscillatory flows by the use of gated detectors. Expressions are here derived for the resulting photon-count auto correlation function in the case where the gating pulses have a simple periodicity. Example correlograms taken in the turbulent air flow over gravity waves are presented which show the effect of such sampling methods and the necessary corrections are indicated in order that true estimates of turbulence intensity be obtained from these records.

**39329 Remote measurement of wind velocity - the time-of-flight laser anemometer.** Lading, L.; Jensen, A.S.; Fog, C.; Rasmussen, E. (Riso Forsogsanlaeg, Roskilde, Denmark). pp 223-232 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

The possibility of fabricating a laser anemometer suitable for ranges up to 100 m with spatial and temporal resolutions better than the Kolmogorov scales is discussed. $CO_2$ and argon laser systems are considered in terms of Doppler reference beam and differential, differential Doppler, reference beam Doppler, time-of-flight, and time-of-flight reference beam configurations. The time-of-flight $CO_2$ argon system was constructed for measuring the particle velocity by measuring the temporal pulses of particles from single particles. Good agreement with cup anemometry was obtained at 20-27 m above the ground using a 6 deg admittance angle. Further development employing multiple particle measurements is indicated.

**39330 Experimental comparison between laser Doppler anemometry and laser fluorescence anemometry.** Benecchi, S.; Cignoli, F.; Coghe, A.; Zizak, G. (CNR, Centro Nazionale di Ricerca sulla Tecnologia della Propulsione e dei Materiali Relativi; Milano, Politecnico, Milan, Italy). pp 233-240 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

Differences in theory and appropriate applications of laser Doppler anemometry (LDA) and laser fluorescence anemometry (LFA) were determined experimentally. Optical filtering due to longer wavelength emission is noted to be possible with LFA and not with LDA. LDA is based on the elastic scattering of monochromatic radiation by a particle, while LFA involves monochromatic light which is absorbed and then re-emitted as broadband radiation by the fluorescent material used. An analysis is presented of the photocurrents of both LDA and LFA. Trials using disodium fluorescin in water and rhodamine 6G in ethylene glycol for measuring an air flow from an air blast nebulizer were performed with photodetectors collecting scattered and fluorescence signals to simultaneously examine LDA and LFA. Flow velocity information was equal, while a lower signal level was found in LFA.

**39331 Particle sizing by Mie scattering.** Brioschi, C. (CNR, Centro Nazionale di Ricerca sulla Technologia della Propulsione e dei Materiali Relativi; Milano, Politecnico, Milan, Italy); Coghe, A. pp 251-259 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

Both the amplitude and visibility of signals scattered by individual particles in a dual beam laser velocimeter can be used for particle sizing. To verify the validity of these techniques in the 5-100 micron range, a comparison between signal amplitude and visibility vs particle diameter has been performed. Different geometrical configurations of the LDV optical system were considered and detailed numerical results have been calculated from Mie theory, indicating a complicated dependence of both the signal amplitude and visibility on scattering parameters.

**39332 Development of the Michelson interferometer.** Andrews, I.M. (IMA Measurement Services, Ltd., Fareham, Hants., England). pp 380-394 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

A large proportion of modern optical displacement measuring instruments are derived from the simple Michelson two beam interferometer. In this paper the modifications are discussed which have been applied to the basic optical arrangement to achieve control of sensitivity, working range, target distance and directional re-

sponse. The theme of this paper is to concentrate on the common origin of these instruments and by association to provide a framework for further development.

# 45 EXPLOSIONS AND EXPLOSIVES

## 4501 Chemical

**39333 (SAND—83-1147C) Large-scale experiments on the transmission of fuel-air detonations from two-dimensional channels.** Benedick, W.B.; Knystautas, R.; Lee, J.H.S. (Sandia National Labs., Albuquerque, NM (USA); McGill Univ., Montreal, Quebec (Canada). Dept. of Mechanical Engineering). 1983. Contract AC04-76DP00789. 16p. (CONF-830704—4). NTIS, PC A02/MF A01. Order Number DE83013097.

From 9. international colloquium on dynamics of explosions and reactive systems; Poitier, France (3 Jul 1983).

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Results of large-scale experiments on the transmission of hydrogen-air and ethylene-air detonations from a two-dimensional channel into a large volume are reported. These data confirm the surprising observations of Liu et al who reported recent laboratory-scale results which indicate that successful transmission of a detonation emerging from a rectangular orifice with a large aspect ratio L/W ~/> 5, requires that the minimum width of the channel need be only about three detonation cell diameters, i.e. W/sub c/ $\approx$ 3 $\lambda$. These results are surprising in view of the previous findings of Soloukhin and Edwards, where for square channels (L/W = 1), they observed that W/sub c/ $\approx$ 10 $\lambda$. The apparatus for the large-scale experiments consisted of a two-dimensional confined channel (1.83 m wide x 2.44 m long) with a variable width orifice, to the end of which was attached an inflated polyethylene bag of much larger dimensions to provide an unconfined environment for detonation transmission. Observations were made with high speed cinematography and with smoked foils to measure the detonation cell size.

## 4502 Nuclear

*REFER ALSO TO CITATION(S) 39316*

**39334 (NVO—209-Rev.3) Announced United States nuclear tests, July 1945-December 1982. Rev. 3.** (USDOE Nevada Operations Office, Las Vegas). Jan 1983. 79p. NTIS, PC A05/MF A01. Order Number DE83012962.

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This document lists chronologically and alphabetically by event name all nuclear tests conducted and announced by the United States from July 1945 through December 1982, with the exception of the GMX experiments. On August 5, 1963, US and USSR signed the Limited Test Ban Treaty. All US nuclear tests conducted prior to that date have been announced and are listed in this document. Some tests conducted underground since the signing of the Treaty and designed to be contained completely have not been announced.

**39335 (SAND—83-1176C) Sea-ice penetration technology with Arctic applications.** Young, C.W. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 10p. (CONF-830555—1). NTIS, PC A02/MF A01. Order Number DE83012322.

From 23. Minefield conference; White Oak, MD, USA (24 May 1983).

During naval operations in the open ocean, submarines, surface ships, and aircraft work individually or in combination to assist in the successful completion of that operation. Some tasks must be performed by a certain type of craft, while for other tasks the more efficient or more practical craft is selected. In the Arctic there is what is perceived by many to be an impenetrable shield between the submarine and the aircraft, with no surface ship capability during most of the year. The shield is the Arctic ice pack. Of all the papers planned for presentation at the 23rd Minefield Conference, only two address the subject of sea ice penetration. This paper suggests that the ice pack is not an impenetrable shield, and that the technical capabilities of both the Naval Sea and Air Systems Commands again be combined for naval operations in the Arctic. The first portion of this paper summarizes the sea ice penetration technology, and then possible Arctic applications are discussed.

**39336 (UCID—19812) Review of geomechanics data from French nuclear explosions in the Hoggar granite, with some comparisons to tests in US granite.** Heuze, F.E. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01. Order Number DE83012881.

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Numerous unclassified reports on the French nuclear explosions in the Hoggar (1961-1966) were reviewed from the standpoint of geomechanics. The following aspects of the tests are summarized: spectral content of the tests compared to U.S. results; shock front positions with time; cavity radius as a function of yield, coupling, density of rock, rock shear strength, and overburden; radial pressure, tangential pressure and peak velocity as a function of distance and yield; pressure vs. time at various distances; mechanical properties of granite; scaling laws for acceleration, velocity and displacement as a function of yield and distance for all Hoggar shots; extent of tunnel damage as a function of distance and yield; time to collapse of chimney as a function of yield, or cavity radius; extent of granite crushing and disking as a function of distance and yield cavity height relation to cavity radius; faulting and jointing on the Taourirt Tan Afella massif; and influence of water content on cavity radius vs. yield. Whenever possible, these French data are compared to corresponding data obtained in the U.S. granite events Hard Hat, Shoal, and Piledriver. The following results emerge from the comparison: (1) agreement is found between the French and U.S. experience for: mechanical properties of the granites, rock damage due to the blast, and yield-scaled peak values of acceleration, velocity and displacement; and (2) lack of agreement exists for: cavity size, chminey height, and time to cavity collapse. Average spacing of rock joints also was about 5 times greater in the Hoggar.

**39337 (UCRL—53396) Modeling of silo response to ground motion.** Thigpen, L.; Peterson, J.C. (Lawrence Livermore National Lab., CA (USA)). 1 Mar 1983. Contract W-7405-ENG-48. 90p. NTIS, PC A05/MF A01. Order Number DE83013534.

The response of a silo-type structure to the ground motion resulting from a near-surface nuclear burst is modeled. This complex problem is modeled using the soil island approach, which combines finite-difference and finite-element methods. The free-field ground motion is determined using a two-dimensional finite-difference code in the absence of a structure. The temporal motions at a boundary that surround the soil island are saved and converted to appropriate three-dimensional values. The resulting boundary condition is then used to load the soil island, which contains the structure and surrounding soil. The top surface of the soil island is loaded with the Brode airblast function. The silo response is modeled using a three-dimensional finite-element code with explicit time steps.

## 4503 Explosion Detection

*REFER ALSO TO CITATION(S) 39466*

**39338 (SAND—82-2193) Dependence of fractional standard deviation of seismic yields on number of calibration events.** Garbin, H.D. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1983. Contract AC04-76DP00789. 19p. NTIS, PC A02/MF A01: 1. Order Number DE83013525.

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Fractional Standard Deviation (FSD) of yields for a suite of NTS events are predicted from calibration curves and are dependent on the number of events used in determining these curves. This results in an FSD history that allows us to estimate how well yield can be determined as a function of the number of calibration shots.

The analysis is applied to both the Sandia Seismic Net and a Laser Strain Seismometer. The results for short period waves have deviations bound between 1.7 and 1.3 while long period FSD varies between 1.5 and 1.15. In the long period analysis, the asymptotic value of the FSD is reached much quicker than in the short period case.

# 50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

## 5001 Basic Studies

**39339 (CNEN-DIN—01/82) Analysis of the wind rose at Itaorna, Brazil.** Nicolli, D. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). May 1982. 24p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702048.

The Angra-I nuclear power plant is located on the southeastern coast of Brazil, in a bowl-shaped area with hills on three sides and a bay on the fourth side. To the north the surrounding hills rise to more than 600 meters, in the other directions they are lower. At the bottom of this area a meteorological mast 50 meters high was installed. Hourly measurements of temperature differences between two levels, as well as wind speed and direction at 50m height were carried out. The wind speed and direction are analysed. The daily air flow at the site shows two distinct characteristics: one nocturnal flow from NE due to the combined effects of the trade and the katabatic winds and a diurnal flow from SW-W generated by the sea breezes. Throughout the year this 'normal' condition is disturbed by low pressure systems that move over the region. For about 10% of the time these weather systems account for the disturbed flow regime in which the winds change direction in a counterclockwise sense. During the day the sea breezes are suppressed by the backing of the winds as well as the trade and katabatic winds during the night.

## 5002 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 38376, 38380, 38381, 38382, 38413, 38433, 39154, 39397, 39480*

**39340 (AD-A—125025/7) Investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications. Master's thesis.** Bramer, J.R. (Naval Postgraduate School, Monterey, CA (USA)). Oct 1982. 72p. NTIS, PC A04/MF A01.

Seven fuel additives were tested to investigate their effectiveness at reducing exhaust stack gas opacity in a turbojet test cell. Exhaust particle sizes and mass concentrations were determined at the engine and stack exhausts using measurements of light transmittance at three frequencies. Particle samples were also collected at the engine exhaust and measured with a scanning electron microscope to verify the optical technique. Nitrous oxide emissions were measured at the test cell stack exhaust. Four of the additives tested were found effective at reducing stack exhaust opacity and particulate mass concentration. None of the additives had any measurable effect on particle diameters. No meaningful changes in particle size or mass occurred between the engine and stack exhausts. The optical technique for determining particle size was verified effective using the scanning electron microscope. No additive had any significant effect on nitrous oxide production.

**39341 (CONF-830338—4) Temporal fluctuations of formaldehyde levels inside residences.** Gammage, R.B.; Hingerty, B.E.; Matthews, T.G.; Hawthorne, A.R.; Womack, D.R.; Westley, R.R.; Gupta, K.C. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE83009788.

From APCA specialty meeting on measurement and monitering of non-criteria toxic contaminants; Chicago, IL, USA (22 Mar 1983).

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Excursions in the levels of formaldehyde were measured inside three houses. These were a 10-y-old home, a 3 y-old home prefitted with urea-formaldehyde foam insulation (UFFI), and a 2-y-old energy-efficient home. Measurements of formaldehyde were made using active and passive air-sampling devices with subsequent colorimetric analysis by the pararosaniline procedure. The variation of diurnal formaldehyde concentrations inside each house varied by up to a factor of two. Over the course of a year, the formaldehyde concentration within the 3-y-old UFFI house varied by an order of magnitude. These changes appeared to correlate with factors such as changes in the temperature, weather, and occupant activity. Inside the 2-y-old house the effects on formaldehyde levels of increased ventilation rate and the operation of a small charcoal-based air cleaner were studied. The results suggest that formaldehyde levels were not inversely proportional to the air exchange rate and that the air cleaner tested were ineffective.

**39342 (CSS/CI—83-05) NO/sub x/ formation from the combustion of agricultural and forest residues.** Lester, T.W.; Merklin, J.F.; Zamani, H.; Roenigk, R. (Kansas State Univ., Manhattan (USA)). 1983. 17p. (CONF-830358—19). Kansas State University, Manhattan, KS 66506. Order Number DE83902099.

From Spring meeting of the Central States Section of the Combustion Institute; Lexington, KY, USA (21 Mar 1983).

The NO/sub x/ emissions resulting from the suspension firing of agricultural residue and pulverized coal were examined. In staged combustion, for all fuels tested, as the first stage stoichiometry increased from 0.5, the exhaust NO/sub x/ emissions decreased, reached a minimum, and then increased. This minimum was less than 50% of the NO/sub x/ level observed under unstaged combustion at 3% excess oxygen for all fuels. The behavior of the NO/sub x/ emissions evidenced from this study suggest that NO/sub x/ control strategies using staged combustion can be applied successfully to highly volatile agricultural fuels, provided slagging in the first stage can be avoided. The axial compositions of solids were determined for all fuels tested. It was found that a 75 cm from the burner, more than 90% of the carbon, 95% of the nitrogen, and 97% of the hydrogen of the fuel had been consumed. Any variations in the NO/sub x/ emissions from the individual fuels does not reflect a lack of nitrogen evolution from the fuel or incomplete carbon burnout.

**39343 (DOE/EV/10403—12) Resolution of source contributions to environmental samples. Progress report, July 1, 1982-June 30, 1983.** Hopke, P.K. (Illinois Univ., Urbana (USA). Inst. for Environmental Studies). Jul 1983. Contract AC02-80EV10403. 39p. NTIS, PC A03/MF A01. Order Number DE83013555.

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The objective is to improve the methods for applying target transformation factor analysis to the quantitative apportionment and to verify the methodologies using sample mixtures created from known, well-characterized source materials. An iterative procedure using a weighted rotation has been demonstrated capable of developing source profiles with no a priori assumptions. A calculational approach to the determination of uncertainties in the factor loadings and scores has been developed. The focus of this report are the studies that have been made during the past year using two data sets with known structure. One set was created using computer simulation employing a dispersion model. The other was a set of element concentrations and mineral phase determination for a series of coal samples. The results of various forms of TTFA are presented and compared.

**39344 (DOE/NBB—0036) Carbon dioxide emissions from fossil fuels: a procedure for estimation and results for 1950-1981.** Marland, G.; Rotty, R.M. (Oak Ridge Associated Universities, Inc., TN (USA)). Jun 1983. Contract AC05-76OR00033. 77p. NTIS, PC A05/MF A01. Order Number DE83013972.

In attempting to identify the possible causes and consequences of the observed increasing atmospheric $CO_2$ concentration, the source of the $CO_2$ is a major concern. Through the past several decades, the combustion of fossil fuels has grown immensely and it is clearly an important source of $CO_2$. This study provides detailed documentation for a procedure to estimate $CO_2$ emissions from fossil fuels, and makes independent and updated estimates of the

rate at which fossil fuel combustion has released carbon dioxide to the atmosphere. This work is intended to provide independent and updated estimates of $CO_2$ emissions and undue significance should not be attached to minor differences from previously published values.

39345 **(EPRI-EA—1498-Vol.3) Plume conversion rates in the SURE Region. Volume 3. Final report.** Easter, R.C.; Hales, J.M.; Sverdrup, G.M.; Spicer, C.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 110p. NTIS, PC A06/MF A01. Order Number DE83014088.

Modeling studies of chemical transformations in plumes from fossil-fueled power plants, during the first several hours of plume transport are reported. The work involved development and application of a two-dimensional photochemical, plume model and further analysis of aerosol data from an earlier study. The model treats homogeneous chemical processes in a plume under non-humid conditions. The model assumes elliptical symmetry in plume cross-sections and utilizes a gradient transport (K) theory treatment for plume dispersion. Formation of secondary pollutants (sulfate, nitric acid, PAN, ozone) is greatest under conditions of high solar radiation, rapid plume dispersion, and high background air hydrocarbon levels, and is quite sensitive to variations. (Sulfate formation was less sensitive to hydrocarbon levels). Predicted transformation rates were insensitive to the magnitude of $SO_2$ emissions and mildly sensitive to NO emissions. For optimal conditions appropriate to the northeast and midwest US, model-predicted transformation rates were 3 to 5% $hr^{-1}$ for $SO_2$ and 15 to 20% $hr^{-1}$ for NO/sub x/ . The relative performances of a quasi-one-dimensional plume model and a condensed chemical kinetic mechanism are also discussed.

39346 **(MLM—3071-(OP)) Evaluation of hazardous-waste incineration in a cement kiln at San Juan Cement.** Peters, J.A.; Hughes, T.W.; Mournighan, R.E. (Monsanto Research Corp., Dayton, OH (USA); Environmental Protection Agency, Cincinnati, OH (USA)). 1983. Contract AC04-76DP00053. 22p. (CONF-830587—1). D. Order Number DE83012571.

From 9. annual research symposium on land disposal, incineration and treatment of hazardous waste; Ft. Mitchell, KY, USA (2 May 1983).

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Some attractive alternatives to hazardous waste incineration which make use of a waste's heat content are cofiring of hazardous wastes in high temperature industrial processes. Many such processes, which include cement and dolomite kilns, glass furnaces, steel furnaces, and some industrial boilers, provide conditions of temperature and residence time similar to those required for dedicated hazardous waste incinerators. In addition to the savings derived from the heat value, the use of existing industrial processes requires less capital to process a given amount of hazardous waste. The ability of a cement kiln to destroy wastes was evaluated. Data was collected to formulate permitting criteria, and to evaluate the kiln's ability to remove the HCl combustion product. A sampling program was conducted during the burning of the hazardous waste. The primary goal of the program was to evaluate the effects of various waste parameters on the destruction efficiency of Principal Organic Hazardous Components (POHC's), and change in emissions of particulate matter, hydrocarbons, CO, $SO_2$, NO/sub x/, and HCl. Secondary objectives were to detect and quantify the Products of Incomplete Combustion (PIC's), chlorinated dibenzofurans, chlorinated dibenzodioxins, trace metals and heavy organics. Results show lower destruction and removal efficiencies, no change in particulate emissions, and significant changes in $SO_2$ and NO/sub x/ emissions. (PSB)

39347 **(N—8314571) Development of mathematical techniques for the assimilation of remote sensing data into atmospheric models.** Seinfeld, J.H. (California Inst. of Tech., Pasadena (USA)). 1982. 106p. (E—83-10062; NASA-CR—169574). NTIS, PC A06/MF A01.

The problem of the assimilation of remote sensing data into mathematical models of atmospheric pollutant species was investigated. The data assimilation problem is posed in terms of the matching of spatially integrated species burden measurements to the predicted three-dimensional concentration fields from atmospheric diffusion models. General conditions were derived for the reconstructability of atmospheric concentration distributions from data typical of remote sensing applications, and a computational algorithm (filter) for the processing of remote sensing data was developed.

39348 **(PB—83-171926) Stripping $SO_2$-loaded citrate solutions with pressurized steam. Report of investigations/1982.** Lien, R.H. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). Dec 1982. 14p. NTIS, PC A02/MF A01.

The Bureau of Mines has conducted research on a flue gas desulfurization (FGD) process as part of its goal of minimizing the undesirable environmental impacts associated with sulfur dioxide (SO2)-bearing waste gases. This FGD process, referred to as the modified citrate process, involves absorption of SO2 in a buffered citric acid solution. The absorbed SO2 is subsequently stripped from the solution using steam, which regenerates the solution and produces a wet SO2 product. This product can be further processed to make sulfuric acid or liquid SO2.

39349 **(PB—83-173203) Acid precipitation effects on algal productivity and biomass in Adirondack Lakes. Final completion report.** Hendrey, G.R. (Cornell Univ., Ithaca, NY (USA). Center for Environmental Research). Dec 1982. 12p. NTIS, PC A02/MF A01.

Relationships between phytoplankton communities and lake acidity in three Adirondack Mountain Lakes were studied at Woods Lake, Sagamore Lake (pH ca. 5.5), and Panther Lake (pH ca. 7.0). Numbers of phytoplankton species observed were Woods 45, Sagamore 55, and Panther 85, conforming to observations at many other sites that species numbers decrease with increasing acidity. The smaller plankton are relatively more important in the more acid lakes, Woods > Sagamore > Panther. This pattern could be determined by nutrient availability (lake acidification is suspected of leading to decreased availability of phosphorus). The amount of 14C-labelled dissolved photosynthate (14C-DOM), as a percent of total productivity, is ordered Woods > Sagamore > Panther.

39350 **Development of a second-generation mathematical model for urban air pollution-II. Evaluation of model performance.** McRae, G.J.; Seinfeld, J.H. (California Inst. of Tech., Pasadena). *Atmospheric Environment;* **17**: No. 3, 501-522(1983). Contract FG03-76ER10058.

The performance of a new comprehensive model for urban-scale photochemical air pollution is evaluated. The model accurately reproduced the important features of ozone ($O_3$) and nitrogen dioxide ($NO_3$) distributions over the South Coast Air Base in of California for a two-day period 26-27 June 1974. Various statistical measures of model performance are reported together with predicted and observed concentration time histories at selected monitoring sites. A new technique for estimating error bounds on emission inventories is also described. The method incorporates the influence of uncertainties in both mass emission rates and chemical reactivity.

39351 **An eddy-correlation measurement to $NO_2$ flux to vegetation and comparison to $O_3$ flux.** Wesely, M.L.; Eastman, J.A. (Argonne National Lab., IL); Stedman, D.H.; Yalvac, E.D. *Atmospheric Environment;* **16**: No. 4, 815-820(1982).

Eddy-correlation measurements with a newly developed fast-response NO/sub x/ sensor indicate that the deposition velocity at a height of about 6 m above a soybean field has a maximum value near 0.6 cm $s^{-1}$ for NO/sub x/ and is usually about 2/3 of that found for ozone. In these studies, over 90% of the NO/sub x/ is $NO_2$. The corresponding minimum surface resistance for NO/sub x/ calculated as the quantity remaining after atmospheric resistances are subtracted is about 1.3 s $cm^{-1}$, which is larger than expected on the basis of leaf stomatal resistance alone. Emission of NO from sites in the plant canopy and soil where $NO_2$ is deposited and reduced to NO or release of NO/sub x/ as a result of biological activity may have lessened the downward fluxes of NO/sub x/

as measured. During windy conditions at night, surface resistances are found to have values of about 15 s $cm^{-1}$ for NO/sub x/ (again, greater than 90% $NO_2$) and 1.8 s $cm^{-1}$ for $O_3$, corresponding to deposition velocities of 0.05 cm $s^{-1}$ and 0.3 cm $s^{-1}$, respectively.

**39352 Stability of sulfur dioxide in formaldehyde absorber and its anomalous behavior in tetrachloromercurate(II).** Dasgupta, P.K.; DeCesare, K.B. (Univ. of California, Davis). *Atmospheric Environment;* **16**: No. 12, 2927-2934(1982).

Stability of $SO_2$ in a buffered formaldehyde absorber has been found to be excellent (<0.2% loss/day at 50°C) compared to mercury (II) absorbers currently in use. The anomalous oxidation pattern of S(IV) in Hg(II)-Cl(-I) media reported previously is explained in terms of an oxidation model in which $Hg^{2+}$ catalyzes the oxidation of S(IV). The mercury complex involved is actually a kinetically inert sulfonic acid complex in which the formal oxidation state of sulfur is +6. The best fit value for the uncatalyzed first order rate constant for sulfite oxidation is $1.35 \times 10^{-7} s^{-1}$ and that for the second order process catalyzed by $Hg^{2+}$ is $1.10 \times 10^{13}$/ $mol^{-1} s^{-1}$.

**39353 An ambient experimental study of phase equilibrium in the atmospheric system: aerosol $H^+$, $NH_4^+$, $SO_4^{2-}$, $NO_3^-$-$NH_3$/sub (g)/, $HNO_3$/sub (g)/.** Tanner, R.L. (Brookhaven National Lab., Upton, NY). *Atmospheric Environment;* **16**: No. 12, 2935-2942(1982).

A major simplification in the quantitative modeling of the atmospheric impact of the major aerosol and gaseous sulfur and nitrogen compounds would result from demonstration of phase equilibrium between the gases $NH_3$, $HNO_3$ and the appropriate aerosol-phase ionic or molecular species in the ambient atmosphere. The phase diagram of the $(NH_4)_2SO_4$-$H_2SO_4$-$H_2O$ and $NH_4NO_3$-$H_2O$ systems have been recently refined by experimental measurements and preliminary calculations of the mixed nitrate-sulfate system have also been made. Experiments to test the applicability of existing phase equilibria considerations to the ambient atmosphere have been designed and conducted based on newly devised techniques for continuous determination of gaseous $NH_3$ with time resolution <5 min and unambiguous speciation of nitric acid and aerosol nitrate with time resolution of approximately 15 min. Preliminary results suggest that during a daytime period with aerosol composition approximating a letovicite-$NH_4NO_3$ mixture, observed products of $NH_3$(g) and $HNO_3$(g) concentrations agreed very well with the equilibrium constant calculated for the ammonium nitrate-$NH_3$(g), $HNO_3$(g) equilibrium. During a night-time period, the predicted ammonia concentrations, based on bulk aerosol composition data, were much lower and nitric acid concentrations much higher, respectively, than the observed values. The error sources in the measured and calculated values do not appear to account for the apparent deviations from gas-phase concentrations based on the droplet-pH-controlling bisulfate-sulfate equilibrium.

**39354 Technique for determining pollutant emissions from a gas-fired range.** Traynor, G.W.; Anthon, D.W.; Hollowell, C.D. (Lawrence Berkeley Lab., Berkeley, CA). *Atmospheric Environment;* **16**: No. 12, 2979-2987(1982). Contract W-7405-ENG-48.

Laboratory measurements of pollutant emissions from a gas-fired range have shown that carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, formaldehyde and respirable particles were all emitted during the combustion process. Carbon was found to be the dominant element of the respirable particles emitted. A mathematical indoor air quality model was applied to our laboratory studies to calculate pollutant emission rates per caloric value of fuel consumed. The model was also used to calculate the temporal profile of the indoor pollution concentrations as well as to determine indoor pollutant decay rates from mechanisms other than air infiltration. Comparisons of measured and calculted data showed good agreement, and suggests that this model may be useful for determining pollutant emissions from a wide variety of other sources, for estimating pollution levels in other indoor environments, and for evaluating pollutant control strategies.

**39355 (LF-tr—128) Classification performance of virtual impactor.** Yoshida, H.; Fujii, K.; Yonemoto, Y.; Masuda, H.; Iinoya, K. Translated from *Kagaku Kogaku Ronbunshu ;* **4**: No. 4, 419-424(1978). Contract AC04-76EV01013. 17p. NTIS, PC A02/MF A01. Order Number DE83013080.

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Theoretical studies of separation efficiency of a virtual impactor have been conducted. It is found that the inertia parameter of 50% partial separation efficiency becomes smaller as the ratio of slit width to pipe radius decreases, while it becomes larger as the ratio of straight to total flow rate or the flow Reynolds number in an inlet pipe decreases. Thickness of the pipe wall at the slit does not affect separation efficiency. Experiments are carried out by using 3 to 4 μm monodisperse methylene blue-uranine aerosol generated by a spinning disk. These experimental results agree well with the calculated values obtained by use of a potential flow model. The classification performance is slightly inferior to that of a conventional impactor. It is also observed that the amount of particles deposited at the inlet tip of straight-through pipe is not negligible under some operating conditions.

**39356 (LF-tr—124) Anisokinetic sampling errors for aerosols.** Yoshida, H.; Ohsusi, T.; Masuda, H.; Yuu, S.; Iinoya, K. Translated from *Kagaku Kogaku Ronbunshu ;* **2**: No. 4, 336-340(1976). Contract AC04-76EV01013. 13p. NTIS, PC A02/MF A01. Order Number DE83013081.

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To examine the error in measuring particle concentration due to anisokinetic sampling over a wide range of inertial parameters, theoretical and experimental studies have been conducted using methylene blue-uranine aerosol generated by a spinning disk and lycopodium spores in the small and large inertial regions respectively. Theoretical results obtained under the assumption of potential flow are in good agreement with experimental data and estimation of anisokinetic sampling errors may be possible. It is also recognized that concentration error becomes smaller as the sampling velocity becomes extremely high. The amount of particles deposited in the probe is also examined and interesting results are obtained such as the fact that the deposit shows the minimum value at Reynolds numbers from 2000 to 3000 and that the amount of particles deposited in an acrylic probe is larger than in a brass one.

## 5003 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 38432, 38523, 39366, 39368, 39379, 39382*

**39357 (AERE-R—10485) Radioactive fallout in air and rain: results to end of 1981.** Cambray, R.S.; Playford, K.; Lewis, G.N.J. (UKAEA Atomic Energy Research Establishment, Harwell. Environmental and Medical Sciences Div.). Jul 1982. 43p. Available from H.M. Stationery Office, price Pound3.00.

Samples of atmospheric dust and rainwater have been collected from the United Kingdom and elsewhere. Results are presented of analyses of these samples for various fission products and certain other radionuclides. The average concentrations of long-lived fission products in air and rain in the United Kingdom in 1981 were about three times those in 1980 and about 2% of the maximum which was reached in 1963-64. About two thirds of the caesium-137 in air near ground level in the United Kingdom in 1981 was attributable to the Chinese explosion of 16 October 1980. Plutonium concentrations in air and rainwater generally follow the pattern of long-lived fission products. In the southern hemisphere the mean concentration of caesium-137 in air in 1981 was about two thirds that in 1980. An estimate is made of the worldwide deposit of caesium-137 and strontium-90. The gamma and beta-ray dose rates from fallout at Chilton are estimated from the observed deposition.

**39358 (DOE/EV/10374—3) Measurement of $^{222}Rn$ indoors and outdoors. Progress report, June 1, 1982-May 31, 1983.** Harley, N.H.; Altman, S.M. (New York Univ., NY (USA). Medical Center). 1983. Contract AC02-80EV10374. 69p. NTIS, PC A04/MF A01. Order Number DE83013008.

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Research progress is reported on a study of the levels and variability of Radon 222 both indoors and outdoors. Sensors were deployed in a single family dwelling and in a high-rise apartment building. Temperature, pressure, relative humidity, rainfall, and wind data were also collected at these sites. Modeling of indoor radon concentrations has been initiated. (ACR)

39359 **(DP—1646) NRC145-2, a computer code to assess dose from accidental pollutant releases.** Pendergast, M.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). May 1983. Contract AC09-76SR00001. 52p. NTIS, PC A04/MF A01. Order Number DE83013805.

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A computer code has been developed to calculate the cumulative frequency distributions of dose following an accidental release from a stack or from a building penetration such as a vent. The calculations of relative concentration are based on the Gaussian plume equations. The meteorological data used for the calculation are in the form of joint frequency distributions of wind and atmospheric stability. The computer code permits the user to select many different meteorological options such as dry deposition, plume rise, diffusion coefficients and adjustments for averaging time. The computer code permits radiological dose to be determined from inhalation, submersion and shine dose from a semi-infinite cloud. The code also permits shine dose from a finite cloud to be determined for postulated SRP reactor accidents.

39360 **(DP—1651) Atlantic Coast Unique Regional Atmospheric Tracer Experiment (ACURATE).** Schubert, J.F.; Heffter, J.L.; Mead, G.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). May 1983. Contract AC09-76SR00001. 16p. NTIS, PC A02/MF A01. Order Number DE83013424.

The Atlantic Coast Unique Regional Atmospheric Tracer Experiment (ACURATE) is a program designed to obtain data necessary to evaluate atmospheric transport and diffusion models used to calculate regional population doses caused by nuclear facility emissions to the atmosphere. This experiment will significantly improve the basis for evaluating the cost effectiveness of different methods of managing airborne nuclear wastes. During the period from March 1982 through September 1982, twice daily air samples have been collected at each of five sampling stations located on a radial from the SRP to Murray Hill, NJ (1000 km). Kr-85 emitted from the F and H area chemical separations facilities is being used as a tracer to determine the transport and diffusion of atmospheric releases from the SRP. The Kr-85 concentrations in the air samples will be compared with the calculated concentrations as predicted by the transport and diffusion models. The Kr-85 data and the meteorological data are being archived and will be made available to the modeling community.

39361 **(PB—83-173286) Recharge in semiarid mountain environments.** Gross, G.W. (New Mexico State Univ., Las Cruces (USA). New Mexico Water Resources Research Inst.). Jun 1982. 45p. NTIS, PC A03/MF A01.

A systematic investigation of tritium activity in precipitation, surface water, springs, and ground water of the Roswell artesian basin in New Mexico, has been supplemented by hydrogeologic reconnaissance of spring systems; by various statistical correlations and spectral analysis of stream flow and water level records of observation wells; by spring discharge measurements; by stable isotope determinations (oxygen 18 and deuterium); and by numerical modeling of part of the basin. Two recharge contributions to the Principal or Carbonate Aquifer have been distinguished principally on the basis of their tritium label and aquifer response characteristics. Almost all basin waters (including deep ground water) fall close to the meteoric line of hydrogen/oxygen isotope composition, and this rules out a juvenile origin or appreciable bedrock interaction.

39362 **(WAPD—336) Annual effluent and environmental monitoring report for calendar year 1982.** (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Jun 1983. Contract AC11-76PN00014. 45p. NTIS, PC A03/MF A01. Order Number DE83013470.

The results of the effluent and environmental monitoring program for 1982 at the Bettis Laboratory are presented. The results obtained from the effluent monitoring program demonstrate that the existing procedures for controlling liquid and airborne effluents ensure that all such releases during 1982 were made in accordance with applicable Federal regulations. Evaluation of the effluent and environmental data indicates that the operation of the Laboratory continued to have no adverse effect on the quality of the environment. Furthermore, a conservative assessment of the radiation exposure from the small radioactivity releases from the Bettis Laboratory demonstrated that the dose estimates were too low to measure and were well below the most restrictive dose limits prescribed by the Environmental Protection Agency and the Department of Energy.

### 5006 Regulations

39363 **National Contingency Plan (National Oil and Hazardous Substances Pollution Contingency Plan). Emergency response contacts listing directory.** Washington, DC; National Response Center (1981). 379p. Emergency Response Contacts Listing (G-WER-1), National Response Center, 400 - 7th Street SW, Washington, DC 20690.

Telephone contacts are provided for state and national organizations for emergency response personnel for many environment disasters. (PSB)

## 51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

### 5101 Basic Studies

*REFER ALSO TO CITATION(S) 39393*

39364 **Some comments on niche analysis in canonical space.** Carnes, B.A. (Argonne National Lab., IL); Slade, N.A. *Ecology;* **63**: No. 4, 888-893(Aug 1982).

Discriminant functions have been used to identify axes of niche separation, and dispersion of locations on these axes have, in turn, been interpreted as representing niche width and specialization. We discuss the influence of sampling scheme and choice of niche measures on the results of an analysis conducted in canonical space. Specifically, habitat variables measured at random locations should provide a more representative measure of habitat available than would recording habitat only where animals are observed. Species presence information alone tends to bias the mean habitat toward the one where the most common species is found. If niche specialization is to be measured by distance from the overall mean habitat, each sampling station should receive equal weighting. The most straightforward measure of habitat breadth seems to be the variance or standard deviation of canonical scores. The mean squared distance from the species centroid can then be used as a comparable multidimensional breadth measure. Finally, we suggest that niche overlap be measured via a joint probability density function rather than by area of overlap of concentration ellipses.

## 5102 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 39441, 39445*

## 5103 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 38550, 38557, 38564, 38569, 39362, 39380, 39382, 39427*

**39365 (ISH—3) Range of variation of natural radiation exposure in the Federal Republic of Germany.** Czempiel, E.M.; Schmier, H. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Jul 1981. 259p. (In German). Available from Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.).

The results of an official survey of the terrestrial component of natural gamma radiation in the Federal Republic of Germany are presented here. In order to present this voluminous data in the clearest possible manner a tabular form has been chosen. The numerical data or dose rate measurement in the open air and in houses is supplemented with histograms of frequency distribution.

**39366 (PB—83-172718) Results of environmental radioactivity measurements in the member states of the European Community for air—deposition—water— milk, 1980.** (Commission of the European Communities, Luxembourg). [nd]. 296p. NTIS, PC AE12/MF E12.

The 20th report on ambient radioactivity, using data collected by stations monitoring environmental radioactivity in the ten Member States of the European Community, presents results for artificial radioactivity in the air at ground level and in deposition, and for radioactive contamination of water and of milk. Trends in radioactivity are plotted and the conclusions drawn from the data for each Member State are sumMarized. Results obtained in 1980 were similar to those for 1979 for specific radionuclides and for total beta activity. An atmospheric nuclear test in the Far East in October 1980 resulted in a general short-term increase in radioactivity in the air and in precipitation, but no significant fluctuations were observed in data for milk samples.

**39367 (PNL-SA—11423) Statistics for NAEG: past efforts, new results, and future plans.** Gilbert, R.O.; Simpson, J.C.; Kinnison, R.R.; Engel, D.W. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76RL01830. 14p. (CONF-830610—1). NTIS, PC A02/MF A01. Order Number DE83013825.

From Nevada Applied Ecology Group transuranics (and associated radionuclides) information conference; Las Vegas, NV, USA (28 Jun 1983).

A brief review of Nevada Applied Ecology Group (NAEG) objectives is followed by a summary of past statistical analyses conducted by Pacific Northwest Laboratory for the NAEG. Estimates of spatial pattern of radionuclides and other statistical analyses at NS's 201, 219 and 221 are reviewed as background for new analyses presented in this paper. Suggested NAEG activities and statistical analyses needed for the projected termination date of NAEG studies in March 1986 are given.

**39368 (STL-A—38) Studies on environmental radioactivity in Finland, 1980. Annual report.** (Institute of Radiation Protection, Helsinki (Finland)). Jan 1982. 124p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83902387.

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The results presented here are part of both the nation-wide programme to survey the fall-out levels of radionuclides in Finland and the monitoring programmes carried out in the vicinities of the nuclear power stations at Loviisa and Olkiluoto. Analysis of deposit samples for their $^{3}H$, $^{89}Sr$ and $^{90}Sr$, as well as $^{137}Cs$ and other gamma radionuclide contents was continued. The decrease in $^{90}Sr$, $^{125}Sb$, $^{137}Cs$ and $^{144}Ce$ levels in deposits continued in 1980. $^{89}Sr$ was detected only in samples taken during the last quarter of the year. Simultaneously $^{54}Mn$, $^{95}Zr$, $^{103}Ru$, $^{140}Ba$ and $^{141}Ce$ were detected at the stations having fall-out collectors with an area of 1 $m^2$. Tritium concentrations were in 1980 somewhat lower than in the previous year. The mean annual deposition of tritium at different sampling stations varied from 1.7 kBq/$m^2$ to 3.9 kBq/$m^2$.

**39369 (UCRL—89210) Critical look at studies of radionuclide migration in fractured granite cores.** Isherwood, D.; Failor, R. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 6p. (CONF-830644—1). NTIS, PC A02/MF A01. Order Number DE83012694.

From Nuclear Energy Agency workshop on experimental methodologies in radionuclide sorption; Paris, France (6 Jun 1983).

A series of laboratory experiments studying radionuclide migration were conducted on eleven fractured granite cores from the Climax Stock at the Nevada Test Site. Failor et al (1982) discuss the equipment used, the preparation of the core, the experimental procedure, the data reduction, and the experimental results. They give estimates of the average fracture apertures, retardation values of $^{85}Sr$, /sup 95m/Tc, and $^{137}Cs$ relative to $^{3}H$, and the percentage of each radionuclide retained in the core after each run. To determine the effect of fracture fill material and solution composition on radionuclide migration, they studied both natural and artificial fractures using either natural Climax ground water or distilled water. The results are summarized below along with a discussion of the problems inherent in the experiments and suggestions to minimize these problems.

**39370 Radionuclide export and elimination by coyotes at two radioactive waste disposal areas in southeastern Idaho.** Arthur, W.J. III; Markham, O.D. (Idaho National Engineering Lab., Idaho Falls (USA)). *Health Physics;* 43: No. 4, 493-500(Oct 1982).

Coyote fecal samples were collected near a radioactive waste leaching pond and a solid radioactive waste disposal facility and analyzed for radioactivity. Elevated concentrations of $^{137}Cs$, $^{90}Sr$ and $^{238}Pu$ in the samples from the liquid radioactive waste leaching area were attributed to coyotes ingesting contaminated pond water and/or small mammals. Elevated $^{241}Am$ concentrations in coyote fecal samples collected around the solid radioactive waste disposal facility were due to ingestion of contaminated small mammals. Assumptions relative to the coyote use of these areas permitted an estimate of the maximum quantity of radioactivity exported and eliminated around the facilities. An annual total of 7.2, 31.4 and 1.8 μCi($^{90}Sr$, $^{137}Cs$, $^{238}Pu$, sup(239,240)Pu, $^{241}Am$, $^{242}Cm$ and $^{244}Cm$) was eliminated by coyotes within a 6.3 km radius of the solid radioactive waste disposal facility, liquid waste leaching pond, and control area, respectively. These quantities of radioactivity eliminated by coyotes were similar or less than quantities transported by other mechanisms such as waterfowl and vegetative uptake of radioactivity. Coyotes are a mode of radionuclide transport from the two radioactive waste disposal areas; however, due to the low radionuclide concentrations and low yearly radionuclide inventories in coyote fecal samples, it is doubtful that any significant environmental consequences occur as a result of this transport mechanism.

**39371 Natural radionuclides and heavy metals in soils.** Jaworowski, Z.; Grzybowska, D. (Central Lab. for Radiological Protection, Warsaw (Poland)). pp 275-286 of Management of environment [a felicitation volume presented to Dr A.K. Ganguly]. Patel, B. (ed.) (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). New Delhi, India; Wiley Eastern 40 (1980).

The vertical distribution of radium-226, lead-210 uranium and thorium and some heavy metals in three types of soil (brown formed from loess, podsolic formed from loess and podsolic formed from loamy sands) in the rural regions of Poland down to the depth of 160 cm and in the virgin soils of Alaska down to the depth of 100 cm has been studied and results are presented. The results are discussed.

## 5105 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 38384, 38396, 38460, 38462, 38563, 38568, 38584, 39461*

**39372 (EGG-TF—6236) Test plans for the INEL Slagging Pyrolysis Incinerator Demonstration Test Series.** Tait, T.D.; Mullin, R.J. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1982. Contract AC07-76ID01570. 48p. NTIS, PC A03/MF A01. Order Number DE83013788.

The Andco-Torrax slagging pyrolysis incinerator process is described and related to processing transuranic (TRU) contaminated waste stored at the facility. Major aspects of the TRU waste that affected development of the Demonstration Test Plans are discussed. Test plans are presented for the sludge, coke/wood, and TSA waste Demonstration Tests.

### 5106 Regulations

*REFER ALSO TO CITATION(S) 39363*

## 52 ENVIRONMENTAL SCIENCES, AQUATIC

### 5201 Basic Studies

*REFER ALSO TO CITATION(S) 39390*

**39373 (PB—83-173294) Carbonate aquifer of the Central Roswell Basin: recharge estimation by numerical modeling.** Rehfeldt, K.R.; Gross, G.W. (New Mexico State Univ., Las Cruces (USA). New Mexico Water Resources Research Inst.). Feb 1982. 148p. NTIS, PC A07/MF A01.

The flow of ground water in the Roswell, New Mexico, Artesian Basin, has been studied since the early 1900s and varied ideas have been proposed to explain different aspects of the ground water flow system. The purpose of the present study was to delineate the spatial distribution and source, or sources, of recharge to the carbonate aquifer of the central Roswell Basin. A computer model was used to simulate ground water flow in the carbonate aquifer, beneath and west of Roswell and in the Glorieta Sandstone and Yeso Formation west of the carbonate aquifer.

**39374 Grazing by the intertidal fish Anoplarchus purpurescens upon a distasteful polychaete worm.** Yoshiyama, R.M.; Darling, J.D. (Stanford Univ., CA). *Environmental Biology of Fishes;* 7: No. 1, 39-45(1982). Contract W-7405-ENG-26.

Cirratulid worms are common inhabitants of the central California rocky intertidal zone and appear to offer a potentially rich source of food for intertidal fishes. However, analyses of stomach contents revealed that they do not appear in the diets of the commonest intertidal fishes. Apparently only one species, the eel blenny Anoplarchus purpurescens, feeds on cirratulids in significant amounts. Feeding experiments employing local intertidal fishes showed that the common intertidal cirratulid, Cirriformia luxuriosa, is distasteful to most of the fishes. Only two species ate its tentacles, and only A. purpurescens consistently ate large quantities. We propose that C. luxuriosa possesses a predation-deterring chemical similar to that reported in C. spirabrancha, although A. purpurescens apparently has been able to circumvent this anti-predator mechanism. The ability of A. purpurescens to eat Cirriformia tentacles allows it to tap a seemingly little-used food source, and thus may decrease competition between A. purpurescens and other intertidal fishes. This feeding relationship also represents a possible example of coevolution between a predator and its prey.

### 5202 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 38480, 38562, 39383, 39445*

**39375 (EPA—600/D-82-333) Total alkalinity of surface waters: a national map.** Omernik, J.M.; Powers, C.F. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). 1982. 15p. Environmental Protection Agency, Corvallis, OR 97333.

This map illustrates the regional patterns of mean annual alkalinity of surface water in the conterminous United States. As such, it affords a qualitative graphic overview to the sensitivity of surface waters to acidification. The map is based on data from approximately 2500 streams and lakes and apparent spatial correlations between these data and macro-watershed characteristics, especially land-use.

**39376 (PB—83-169995) Quantitative relations between fishing mortality, spawning stress mortality and biomass growth rate (computed with numerical model FISHMO).** Laevastu, T. (National Marine Fisheries Service, Seattle, WA (USA). Northwest and Alaska Fisheries Center). Jan 1983. 28p. NTIS, PC A03/MF A01.

The effects of fishing on a given species biomass have been quantitatively evaluated. A constant recruitment is assumed in this study, but the evaluation can be computed on any known age distribution of exploitable biomass. Fishing mortality is assumed to be constant with age; however, spawning stress mortality increases with age. When fishing (mortality) increases, the spawning stress mortality decreases relative to total and exploitable biomasses. These changes are quantitatively shown for two species from the Bering Sea - walleye pollock, Theragra chalcogramma, and yellowfin sole, Limanda aspera.

**39377 (PB—83-177998) Packed-bed reactors for concentrated-waste treatment and energy production. Final completion report.** Pedersen, K.B. (Puerto Rico Univ., Mayaguez. Water Resources Research Inst.). 1983. 105p. NTIS, PC A06/MF A01.

The objective of this research project was to study the design parameters of the anaerobic filter process such as organic loadings and hydraulic retention time, and the response of the process in relation to organic matter removal and energy production for a typical condition in Puerto Rico. The organic loading was found to be a very important parameter during the operation of the anaerobic filter. The activity of the filter in removing organic matter evidenced the dependence on the applied organic loading. The continuous variations of the organic loading rates and the considerably high magnitude of such loads in addition to the high concentration of suspended solids could result in dynamic fluctuations between the individual waste components affecting the steady state condition of the organic conversion process causing that none of the three conditions studied have shown a significant improvement in the organic removal and in the gas production rate.

**39378 (USGS-OFR—79-704) Chemical analyses of waters from geysers, hot springs, and pools in Yellowstone National Park, Wyoming from 1974 to 1978.** Thompson, J.M.; Yadav, S. (Geological Survey, Menlo Park, CA (USA)). 1979. 49p. USGS, Open File Service, Box 25425-Denver Federal Center, Denver, CO 80225.

Waters from geysers, hot springs, and pools of Yellowstone National Park have been analyzed. We report 422 complete major ion analyses from 330 different locations of geysers, hot springs, and pools, collected from 1974 to 1978. Many of the analyses from Upper, Midway, Lower, and Norris Geyser Basin are recollections of features previously reported.

### 5203 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 38523, 38559, 38560, 38569, 39361, 39362, 39366, 39368, 39439*

**39379 (CEA-R—5193) Radioactivity of a portion of the Channel shore: new data on sources and transports from marine aerosols and sprays to the continent.** Fraizier, A.; Baron, Y. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Oct 1982. 32p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702056.

The purpose of this study was to gain further knowledge on radionuclide transports of marine aerosols from the ocean to the land. The interpretation of the results using the particles trapped by a vegetal, took into account the two sources of radionuclides-at-

mospheric fallout and disposal of industrial discharges into the sea. Both sources contributed to increasing activity levels along the shore at various degrees which were measured. As compared with the marine environment, similar distributions were noticed (including a number of particular features). The methodology can be used to supplement a study of effluent dispersion into the marine environment. The commited dose equivalent from this pathway was estimated to be below 1/1000 of the I.C.R.P. limits from the members of the public.

39380 **Soil plutonium and cesium in stream channels and banks of Los Alamos liquid effluent-receiving areas.** Nyhan, J.W.; White, G.C.; Trujillo, G. (Los Alamos National Lab., NM (USA)). *Health Physics;* 43: No. 4, 531-541(Oct 1982).

Stream channel sediments and adjacent bank soils found in three intermittent streams used for treated liquid effluent disposal at Los Alamos, New Mexico were sampled to determine the distribution of $^{238}$Pu, sup(239,240)Pu and $^{137}$Cs. Radionuclide concentrations and inventories were determined as functions of distance downstream from the waste outfall and from the center of the stream channel, soil sampling depth, stream channel-bank physiography, and the waste use history of each disposal area. Radionuclide concentrations in channel sediments were inversely related to distances up to 10 km downstream from the outfalls. For sites receiving appreciable waste effluent additions, contaminant concentrations in bank soils decreased with perpendicular distances greater than 0.38 m from the stream channel, and with stream bank sampling depths greater than 20-40 cm. Concentrations and total inventories of radionuclides in stream bank soils generally decreased as stream bank height increased. Inventory estimates of radionuclides in channel sediments exhibited coefficients of variation that ranged 0.41-2.6, reflecting the large variation in radionuclide concentrations at each site. Several interesting temporal relationships of these radionuclides in intermittent streams were gleaned from the varying waste use histories of the three effluent-receiving areas. Eleven years after liquid wastes were added to one canyon, the major radionuclide inventories were found in the stream bank soils, unlike most of the other currently-used receiving areas. A period of time greater than 6 yr seems to be required before the plutonium in liquid wastes currently added to the canyon is approximately equilibrated with the plutonium in the bank soils. These observations are discussed relative to waste management practices in these southwestern intermittent streams.

39381 **$^{137}$Cs in the Svalbard area.** Hallstadius, L.; Holm, E.; Persson, B. (Lund Univ. (Sweden). Radiofysiska Institutionen); Aarkrog, A.; Nilsson, K. (Risoe National Lab., Roskilde (Denmark)). pp 500-505 of Radiological protection - advances in theory and practice. Proceedings of the 3. international symposium held in Inverness, Scotland, 6-11 June 1982. Berkeley, England; Society for Radiological Protection (1982). (CONF-820613—).

From 3. international symposium of the Society for Radiological Protection; Inverness, UK (6 Jun 1982).

As a part of research program carried out on the Swedish Arctic Expedition YMER 80, samples of seawater, sediments and biota have been collected and measured for $^{137}$Cs. The concentrations of $^{137}$Cs in surface water drop from 100-200 mBq $l^{-1}$ to 10-30 mBq, $l^{-1}$ going from the Norwegian coast to the Arctic Ocean. Algae such as Fucus and Laminaria show a dry weight concentration factor of about 70 for $^{137}$Cs. In surface sediments the $^{137}$Cs concentration i about 3-10 Bq $kg^{-1}$. The direct global fallout of $^{137}$Cs is quite small in the Svalbard area. The excess of cesium found (a factor 4 to 5) is assumed to be caused by mixing with Atlantic water from latitudes with higher fall-out levels and also by transport of $^{137}$Cs and $^{134}$Cs released from European reprocessing facilities with the Gulf current.

39382 **Measurement of tritium in some environmental samples in Japan.** Nishiwaki, Y.; Kawai, H.; Morishima, H.; Koga, T. (Japan Atomic Energy Agency, Tokyo). pp 484-505 of Management of environment [a felicitation volume presented to Dr A.K. Ganguly]. Patel, B. (ed.) (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). New Delhi, India; Wiley Eastern (1980).

Atmospheric nuclear tests, nuclear power reactors - especially BWR type reactors, nuclear fuel reprocessing plants, nuclear reaction of high energy neutrons in cosmic rays with $^{14}$N are the sources of tritium entering the environment. One more source in future will be thermonuclear reactors. The two methods of measurement of low level tritium in natural water are: (1) one based on enrichment of tritium by electrolysis and (2) the other based on reducing background count. These methods are described. Data collected on measurement of tritium in various environmental materials such as ground water, rain water, surface sea water in Japan are reviewed and presented. Studies on biological half-life of tritium are also reviewed and biological effects of tritium are briefly described. The tritium concentrations of surface sea water of Japan (in the Pacific ocean) are found to be of the same order of magnitude as the ones measured in the Mediterranean. The level of tritium in the rain in Japan is about the average of the values observed in different parts of the world. The level of tritium in the deep underground water in Japan is lower than that in surface sea water, but is showing a tendency to increase slightly.

39383 **Monitoring method for radioactive and chemical pollution in streams and rivers.** Georgescu, I.I.; Bondar, C.; Roman, P.; Baran, Gh. (Institutul Politehnic, Bucharest (Romania)). pp 302-309 of Management of environment [a felicitation volume presented to Dr A.K. Ganguly]. Patel, B. (ed.) (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). New Delhi, India; Wiley Eastern (1980).

Methods used for sampling of water and sediments of the Danube river to monitor its radioactive and chemical pollution are briefly described. Data on distribution of some radionuclides in a cross-section of the Danube river are given. Dilution Capacity of the Danube river was computed by measuring $^{144}$Ce in two cross-sections placed at 192 km longitudinal distance in the river. The mathematical models for chemical and organic pollution taking into account the principal processes of transport and mixing in rivers are discussed.

39384 **Distribution of caesium-137 in the Mediterranean Sea.** Fukai, R.; Ballestra, S.; Vas, D. (International Lab. of Marine Radioactivity, Monaco). pp 352-360 of Management of environment [a felicitation volume presented to Dr A.K. Ganguly]. Patel, B. (ed.) (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). New Delhi, India; Wiley Eastern (1980).

The International Laboratory of Marine Radioactivity (Monaco) conducted several oceanographic cruises during 1975-1977 to collect data on heavy metals and chlorinated hydrocarbons in the open Mediterranean. Sea water samples for radionuclide measurements were also collected on these cruises. The $^{137}$Cs measurements in these samples are presented and discussed. After collection sea water was immediately acidified to pH 1.5 and $^{137}$Cs was sorbed on solid ammonium phosphomolybdate together with added stable cesium carrier. After dissolution of AMP by NaoH, Cs was separated from K and Rb by ion exchange, precipitated as chloroplatinate and beta-counted. The surface concentrations of $^{137}$Cs in the different areas of the Mediterranean fall in the range of 80-180 fCi $^{137}$Cs/l, the average of all values being 126 +- 7 fCi $^{137}$Cs. The vertical distribution of $^{137}$Cs measured at four different locations varied considerably. It increased from surface to a maximum at a depth between 50m and 250m and then decreased with depth. The depth of maximum concentration differed from station to station but was always above the chlorinity maximum. The vertical distribution, therefore, seems to be closely related to vertical water mass movements. The inventories of $^{137}$Cs delivered by radioactive fallout into the Mediterranean water columns are computed on the basis $^{137}$Cs/$^{90}$Sr activity ratio and presented.

## 5205 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 38480, 38548*

39385 **(PB—83-173302) Baseline study of Oxygen 18 and deuterium in the Roswell, New Mexico, groundwater basin.** Hoy, R.N.; Gross, G.W. (New Mexico State Univ., Las Cruces (USA). New Mexico Water Resources Research Inst.). May 1982. 107p. NTIS, PC A06/MF A01.

The isotopic ratios of deuterium and oxygen 18 were measured in precipitation, surface, and ground water samples from the Roswell Artesian ground water basin in south-central New Mexico. The narrow range of D and 18O indicates mixing effects which are ascribed to one or more of the following factors: long ground water flow paths; large temperature fluctuations affecting which overwhelm the influence of elevation on precipitation; two sources of atmospheric moisture; interaquifer leakage; and recharge from intermittent streams with the flow-length expanding and contracting over large distances. It is concluded that a more precise definition of circulation patterns on the basis of stable isotope differences will require a much greater sampling frequency in both space and time.

### 5206 Regulations

*REFER ALSO TO CITATION(S) 39363*

## 53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

*REFER ALSO TO CITATION(S) 38771*

### 5301 Social And Economic Studies

*REFER ALSO TO CITATION(S) 38409, 38460*

39386 **(IKE—4-110) Behavioural model in social psychology: Model development and model studies on the behavioral intentions of individuals and groups in energy policy problems.** Bergius, R.; Engemann, A.; Guenther, R.; Kimmelmann, G.; Radtke, M.; Sachs, S.; Schmidt, F. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Oct 1982. 472p. (In German). NTIS (US Sales Only), PC A20/MF A01. Order Number DE83751021.

We describe a model which allows to simulate inference and evaluation processes and also the resulting behavioral intentions. The model is the base of the program REASON. The program needs as input knowledge about the part of the world which is to be evaluated and values and criteria which are used to judge the conclusions of the inference process. The program provides as output the scores of the various criteria and accumulated evaluations of the options. Also if desired a protocol of the inference process is available. The program is demonstrated by examples showing support in generating concepts. A detailed concept was developed for the installation of the heating system in a new home. REASON is applied together with this concept to simulate the behavioral intentions of the home owners towards the installation of the various heating systems.

### 5302 Assessment Of Energy Technologies

*REFER ALSO TO CITATION(S) 38598, 38602, 38603, 38967, 39445*

39387 **(PB—83-177592) Energy from biomass: the implications of gasohol from corn.** Newman, L.C.; Johnson, R.C. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1980. 110p. NTIS, PC A06/MF A01.

The major components of the gasohol system discussed are cropland, corn production and use, distilleries, use of distillation by-products in the various feeding sectors, automobiles and the automotive companies, gasoline and the petroleum companies, and gasohol and driver satisfaction. Economic and agricultural impacts, energy supply, employment, and governmental implications are examined. The implications of developing an alcohol program of two billion gallons per year appear to be acceptable. The most significant disadvantages are believed to be associated with the net land demand. These impacts include a higher fixed cost of farming and increased environmental damage and variability of corn supply. Net land demand is reduced if the distillation by-products are substituted against soybean meal for their protein value rather than used on feedlots for their energy value. An external evaluation of this report was conducted by the Division of Policy Research and Analysis of the National Science Foundation and is appended to the main volume of this series.

39388 **(PB—83-177634) Energy from biomass: a technology assessment of terrestrial biomass systems.** Newman, L.C.; Johnson, R.C.; Lay, R.K. (Mitre Corp., McLean, VA (USA). METREK Div.). Dec 1980. 365p. NTIS, PC A16/MF A01.

In this technology assessment, the consequences of the commercial development of four biomass systems were examined. The impacts of such development on selected aspects of government, private industry, and the population in general were analyzed from a public policy perspective. The study also identified policy issues likely to result from the development of biomass energy. Four biomass systems were studied: (1) gasohol production from corn; (2) residential heating with wood; (3) industrial use of wood energy; and (4) methanol production from silvicultural farms. The development scenarios selected for study were based on three levels of sustained annual biomass production by the year 2000. These were (1) 4.1 quadrillion BTUs (quads), a baseline business-as-usual scenario; (2) 10.5 quads, a crisis of supply scenario; and (3) 2.2 quads, a cheap energy scenario. An external evaluation of this report was conducted by the Division of Policy Research and Analysis of the National Science Foundation, and is included, together with a response to the evaluation by the principal investigator of the report.

39389 **Energy, resources and environment.** Yuan, S.W. (ed.). New York, NY; Pergamon Press (1982). 621p. (CONF-821121—).

From 1. US/China conference on energy, resources and environment; Beijing, China (7 Nov 1982).

Separate abstracts were prepared for 70 of the 72 papers of this Proceedings of the First US-China Conference. The other two papers are duplicates of those in the data base. The topics of the papers included depict the importance of energy, resources, and environment and the future trends of their development.

## 55 BIOMEDICAL SCIENCES, BASIC STUDIES

### 5501 Behavioral Biology

39390 **Effects of density on growth, metamorphosis, and survivorship in tadpoles of Scaphiopus holbrooki.** Semlitsch, R.D.; Caldwell, J.P. *Ecology;* **63**: No. 4, 905-911(Aug 1982). Contract AC09-76SR00819.

Density-dependent aspects of growth, metamorphosis, and survivorship of Scaphiopus holbrooki tadpoles were examined in the laboratory under two experimental regimes. In the first density experiment, the growth index (W) of tadpoles decreased exponentially with density. Mean growth rate varied from 0.023 mL/d at the lowest density to 0.006 mL/d at the highest density. The mean number of days to metamorphic climax was positively associated with the initial density treatment: 27 d at the lowest density to 86 d at the highest density. The body size of tadpoles at metamorphosis showed a concave curvilinear relationship to initial density, indicating tadpoles at the highest densities are apparently capable to growth recovery once released from density stress. The survival of tadpoles decreased exponentially with initial density, from 90% at the lowest density to 20% at the highest initial density. In the second experiment a cross-classified design was used to examine the effects of density and duration of treatment (time) on growth and metamorphosis. Density and time had significant effects on body size at metamorphosis and days to metamorphosis. There was no significant interaction between density and time. These results indicate that the inhibitory effect of density stress varies with the duration of the stress. Scaphiopus holbrooki tadpoles exhibit developmental traits (rapid growth, short larval period, small body size at metamorphosis) that should be favored by natural selection in high density habitats. Dispersability may be a mechanism whereby S. holbrooki can minimize the detrimental effects of density stress.

39391 **Intractable properties of responding under a fixed-interval schedule.** Gentry, G.D.; Marr, M.J. (Georgia Inst. of Tech., Atlanta). *Journal of Experimental Analysis of Behavior;* **37**: 233-241(1982).

The behavior engendered by the fixed-interval schedule is characterized by its variability within and across intervals. The present experiment was designed to assess further the magnitude of interval-to-interval dynamics and to explore conditions which might enhance control by response number for subsequent output. Pigeons were exposed to three experimental manipulations after responding had stabilized under a fixed-interval five-minute schedule. First, a discrete five-stimulus counter was added so that the key color changed after a fixed number of responses. Then additional grain presentations were made at the end of the interval so that high response output was differentially reinforced in the presence of the counter stimuli. Finally, the counter stimuli were presented as an irregular clock (i.e., independently of responding), but the durations were yoked to performance under the counter condition. The data show that response number can exert influence from one interval to the next, but this source of control is weak and not influenced by the experimental manipulations. Results from the clock arrangement indicate that behavior is controlled largely by the stimulus conditions prevailing at the time of interval onset.

## 5502 Biochemistry

*REFER ALSO TO CITATION(S) 38660, 39184, 39405*

**39392 (ABCC—05-63) ABCC-JNIH adult health study: Hiroshima. Serum lysozyme determinations, April-June 1961.** Finch, S.C.; Lamphere, J.P.; Jablon, S. (Atomic Bomb Casualty Commission, Nagasaki (Japan)). 1961. Contract AC01-76EV03161. 19p. (In English and Japanese). NTIS, PC A02/MF A01. Order Number DE83902243.

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Serum lysozyme levels were determined on 670 consecutive subjects seen for regularly scheduled clinic examinations of the Adult Health Study in Hiroshima. Serum lysozyme levels were found to vary significantly with the absolute peripheral granulocyte count, age, sex, and month of study. A high level of correlation also was noted between serum lysozyme and diabetes mellitus. This was at least in part attributable to greater average age in patients with diabetes. A suggestive relationship was established between serum lysozyme levels, respiratory diseases, and tuberculosis. These changes are believed to reflect active inflammation with excessive destruction of granulocytes and parenchymal tissues in those patients with the more acute processes. No relationship was found between serum lysozyme and previous exposure to ionizing radiation. These studies indicate that the serum lysozyme level may be useful in the study of the kinetics of leukopoiesis, the aging process, and in the detection of subtle inflammatory processes.

**39393 (CONF-8104206—Absts.) Proceedings of the international symposium on Phytophthore: its biology, ecology and pathology.** (California Univ., Riverside (USA). Dept. of Plant Pathology). 1981. Contract FG03-81ER10891. 90p. NTIS, PC A05/MF A01. Order Number DE83012282.

From International symposium on phytophthora: its biology, ecology, and pathology; Riverside, CA, USA (1 Apr 1981).

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Trends in epidemiology, the physiology and histology of host-parasite interaction, and concepts of disease control by resistant cultivars and by new chemicals were covered in the pathology section. The biology section explored ideas concerned with cytology, morphogenesis, responses of zoospores, role of sterols on sexual reproduction, and diploidy of the vegetative thallus. In ecology, quantification of populations and the relationship of soilborne species to antagonistic microorganisms were discussed to help explain epidemiological concepts. The discussion of taxonomy indicated great differences in opinions on the use of criteria for separating species.

**39394 (DOE/ER/10715—3) Primary gene products as plant defenses. Technical progress report, July 1, 1982-June 30, 1983.** (Purdue Research Foundation, Lafayette, IN (USA)). 1983. Contract AC02-80ER10715. 4p. NTIS, PC A02/MF A01. Order Number DE83013914.

The Bowman-Birk proteinase inhibitor (BBI) and its related family of isoinhibitors (PI I-IV) from soybean represent a group of polypeptides that are closely related in their amino acid sequences. Interest in the proteins comes from their high content of sulfur amine acids and the potential use of their proteinase inhibitor function in natural plant protection. The major focus of this study was to obtain a cDNA probe for the BBI and PI I-IV by standard recombinant DNA techniques. These probes were used to characterize the messenger RNA and to isolate and characterize the genes coding for these polypeptides. (ACR)

**39395 (LA-UR—83-1308) Information storage in DNA sequences.** Burks, C. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 24p. (CONF-830361—1). NTIS, PC A02/MF A01. Order Number DE83012703.

From Cellular automata workshop; Los Alamos, NM, USA (3 Mar 1983).

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We seek to describe a starting point for modeling the evolution of DNA sequences within the framework of cellular automata by discussing the current understanding of genetic information storage in DNA sequences. This includes alternately viewing the role of DNA in living organisms as a simple scheme and as a complex scheme; a presentation of the extent of experimentally determined DNA sequence data present in the Los Alamos Nucleic Acid Database; and finally, a brief review of strategies for identifying and classifying patterns in DNA sequences.

**39396 (PNL-SA—11303) Response of CHO cell DNA polymerase alpha to DCTP and DTTP pool imbalance: relation to DNA synthesis inhibition, survival, and mutation.** Newman, C.N.; Miller, J.H. (Pacific Northwest Lab., Richland, WA (USA)). May 1983. Contract AC06-76RL01830. 46p. (CONF-830572—1). NTIS, PC A03/MF A01. Order Number DE83012605.

From Symposium on genetic consequences of nucleotide pool imbalance; Research Triangle Park, NC, USA (9 May 1983).

Utilizing a deoxynucleoside triphosphate (dNTP) pool-altered, polymerase $\alpha$-altered mutant of CHO-K1 and a permeable cell-DNA synthesis system, the study examines the complicated interrelationship of dNTP pools as potential regulators as well as substrates for polymerase $\alpha$. These findings are then related to the commonly observed uv-induced inhibition of DNA synthesis, and, ultimately, to the biological consequences of exposure to radiation and chemical insults.

**39397 Photosynthesis in submersed macrophytes of a temperate lake.** Beer, S.; Wetzel, R.G. (Michigan State Univ., Hickory Corners). *Plant Physiology;* 70: No. 2, 488-492(Aug 1982).

The photosynthetic carbon fixation pathways and levels of carbon-fixing enzymes of four dominant submersed macrophytes of Lawrence Lake, southern Michigan, were investigated during the main growth season (May to November). All four species (Scirpus subterminalis Torr., Najas flexilis (Willd.) Rostk. and Schmidt, Potamogeton praelongus Wulf., and Myriophyllum heterophyllum Michx.) were $C_3$ plants based on their patterns of $^{14}C$ pulse-chase incorporation. High levels of phosphoenolypyruvate carboxylase were also found in these species. These levels, as well as the ribulose 1,5-biphosphate carboxylase/phosphoenolpyruvate carboxylase ratio of the leaves, varied throughout the growing season and exhibited highest values in July. No shift in carbon fixation pathways, however, could be detected from July to October. The possible functions of phosphoenolypyruvate carboxylase in these plants, as well as the significance of $C_3$ metabolism in submersed plants of temperate lakes, are delineated.

**39398 Histone variants and histone modifications in chromatin fractions from heterochromatin-rich Peromyscus cells.** Halleck, M.S.; Gurley, L.R. (Los Alamos National Lab., NM). *Experimental Cell Research;* 138: No. 2, 271-285(Apr 1982).

In order to investigate the relationship between condensed heterochromatin and histone modification by acetylation, phosphorylation and amino acid variation, chromatin from cultured Peromyscus eremicus cells, containing 35% constitutive heterochromatin, was fractionated into heterochromatin-enriched and heterochromatin-depleted fractions. The constitutive heterochromatin content

of these fractions was determined from satellite DNA content. The distribution of phosphorylated and acetylated histones and amino acid variants of histone H2A in these chromatin fractions was examined by gel electrophoresis. Fractionation of histones demonstrated that endogenous histone phosphatase activity was high in chromatin fractions and could not be inhibited sufficiently to allow accurate histone phosphorylation measurements. However, sodium butyrate did inhibit deacetylation activity in the fractions, allowing histone acetylation measurements to be made. It was found that the constitutive heterochromatin content of these fractions was proportional to both their unacetylated H4 content and their more-hydrophobic H2A content. These observations support, by direct measurement, earlier experiments suggesting that constitutive heterochromatin is enriched in unacetylated arginine-rich histones, and in the more hydrophobic variant of histone H2A.

## 5503 Cytology

39399 **(DOE/SF/00012—T17) Differentiation of purified astrocytes in a chemically defined medium.** Morrison, R.S.; de Vellis, J. (California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences). 1981. Contract AC03-76SF00012. 28p. NTIS, PC A03/MF A01. Order Number DE83012975.

Homogeneous cultures of astrocytes and oligodendrocytes provide an excellent model system for studying the regulation of glial structure and function. Recently, a chemically defined (CD) medium was developed for purified cultures of astrocytes, thus eliminating the requirement for serum and providing a controlled system for the study of astroglial properties. Due to the widespread use of astrocyte cultures and the potential benefits to be gained from using a defined medium, astrocyte cultures raised in CD medium were analyzed for purity as well as morphological and biochemical properties. Purity was assessed using immunocytochemical staining for glial fibrillary acidic protein (GFAP) and fibronectin. Astrocytes raised in CD medium are 95% pure using the expression of GFAP as a criterion. Fewer than 1% of the cells in CD medium stained positive for fibronectin eliminating the possibility that CD medium is selective for meningeal or endothelial cells. Astrocytes raised in CD medium exhibit a striking degree of morphological differentiation as seen in scanning electron micrographs. They also exhibit a high degree of biochemical differentiation illustrated by increases in the specific activity of S-100 protein and the induction of glutamine synthetase by glucocorticoids. A defined medium that supports the proliferation of rat astrocytes and enhances numerous morphological and biochemical properties should greatly facilitate the study of factors controlling glial proliferation and differentiation.

39400 **(DOE/SF/00012—T18) [$^3$H] spiperone binding sites in rat primary cultures, C6 glioma, and B104 neuroblastoma.** Severson, J.A.; de Vellis, J.S.; Finch, C.E. (California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences). 1980. Contract AC03-76SF00012. 12p. NTIS, PC A02/MF A01. Order Number DE83012976.

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Binding sites for [$^3$H] spiperone were detected on membranes from primary glial cultures from neonatal rat cortex and striatum and from the C6 glioma cells. [$^3$H] spiperone binding was displacable by d-butaclamol. However, competition studies suggest that [$^3$H] spiperone binding to primary glial cultures was mainly to serotonergic sites, and binding to the C6 glioma was alpha-adrenergic. No specific binding was detected to membranes from B104 neuroblastoma cells. Although [$^3$H] spiperone binding to glial sites in whole striatum under generally used conditions is small (about 10%), the striatal glial hyperactivity which is often associated with neuronal degeneration could lead to an overestimation of presumed neuronal binding sites for dopaminergic ligands.

39401 **(UCRL—88258) Flow cytometric detection of aberrant chromosomes.** Gray, J.W.; Lucas, J.; Yu, L.C.; Langlois, R. (Lawrence Livermore National Lab., CA (USA)). 11 May 1983. Contract W-7405-ENG-48. 26p. (CONF-8210110—2). NTIS, PC A03/MF A01. Order Number DE83012691.

From International symposium on biological dosimetry; Neherberg, F.R. Germany (14 Oct 1982).

This report describes the quantification of chromosomal aberrations by flow cytometry. Both homogeneously and heterogeneously occurring chromosome aberrations were studied. Homogeneously occurring aberrations were noted in chromosomes isolated from human colon carcinoma (LoVo) cells, stained with Hoechst 33258 and chromomycin A3 and analyzed using dual beam flow cytometry. The resulting bivariate flow karyotype showed a homogeneously occurring marker chromosome of intermediate size. Heterogeneously occurring aberrations were quantified by slit-scan flow cytometry in chromosomes isolated from control and irradiated Chinese hamster cells and stained with propidium iodide. Heterogeneously occurring dicentric chromosomes were detected by their shapes (two centrometers). The frequencies of such chromosomes estimated by slit-scan flow cytometry correlated well with the frequencies determined by visual microscopy.

39402 **Metabolism of 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine by cell cultures.** Cabot, M.C.; Blank, M.L.; Welsh, C.J.; Horan, M.J.; Cress, E.A.; Snyder, F. (Oak Ridge Associated Univ., Tennessee). *Life Sciences;* **31**: No. 25, 2891-2898(20 Dec 1982).

The metabolism of 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine (platelet-activating factor) was studied using various cultured cell lines. All incubations were done in the presence of bovine serum albumin and serum-free media, since albumin eliminates the adsorption of 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine to cultureware and serum enzymes interfere. Human leukemia (HL-60) cells, MDCK canine kidney cells, and transformed and nontransformed clones of mouse C3H1OT1/2 cells display varying rates of uptake, degradation, and capacities for reacylation of 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine. HL-60 cells displayed the highest uptake rate (24.6 pmol/mg cell protein/15 min). Whereas C3H1OT1/2 cells in culture showed uptake rates comparable to other cells tested, they displayed a relative metabolic inertness towards 1-alkyl-2-acetyl-sn-glycero-3-phosphocholine.

## 5504 Genetics

*REFER ALSO TO CITATION(S) 39395*

39403 **(CONF-820439—8) Fv-1 restriction of murine leukemia viruses: a model for studying host genetic control of retroviral gene movement and leukemogenesis.** Yang, W.K.; Boone, L.R.; Tennant, R.W.; Brown, A. (Oak Ridge National Lab., TN (USA); National Inst. of Environmental Health Sciences, Research Triangle Park, NC (USA); Tennessee Univ., Knoxville (USA). Dept. of Microbiology). 1983. Contract W-7405-ENG-26. 28p. NTIS, PC A03/MF A01. Order Number DE83012589.

From Symposium on genetic mechanisms of carcinogenesis; Gatlinburg, TN, USA (11 Apr 1982).

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Since the first isolation of a murine leukemia, it has been noted that transmission of the leukemic disease is very much dependent on the mouse strain selected for the virus inoculation. There are many different genetic determinants that may render the most resistant to viral leukemogenesis. The most well-defined among these resistance genes is the Fv-1 locus, which is present in laboratory strains as well as in wild populations of the mouse. The Fv-1 locus, with its fundamental biology and genetics well established, is ideal for biochemical studies. The molecular mechanism elucidated for this restriction system may provide information useful for further studies to understand the complex genetic factors related to the control of carcinogenesis. Recent understanding of the interaction between host Fv-1 gene and the restricted virus may be summarized as follows: there are dominantly expressed Fv-1 gene products in the cell; there are specific target molecules in the virion; the restriction is an intracellular event which leads to failure of proviral DNA integration. On the basis of these basic facts as well as results of our detailed analysis of retroviral DNA intermediates in the Fv-1 restrictive cells, we have constructed a working hypothesis for the molecular mechanism of Fv-1 gene restriction, which places particular emphasis on the structural and functional

behavior of long terminal repeats (LTR) during the early phase of retrovirus infection.

39404 **(DOE/EV/04159—1) Genetic and developmental study of a complex locus in the house mouse. Final report, 1976-1983.** Bennett, D. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1983. Contract AC02-77EV04159. 11p. NTIS, PC A02/MF A01. Order Number DE83013842.

More than 50 T/t-complex and other mouse chromosome 17 variants have been maintained and used for genetic study. Congenic strains of t-mutants on C3H, 129/TER and LT/sv backgrounds have been constructed. We have continued experiments to extract and analyze t-haplotypes from wild populations of mice, and to define and man other chromosome 17 genes. Most recently we have carried out experiments to map the lethal factors within t-haplotypes relative to one another, utilizing recombination that we have found to occur freely between two different complementing t-haplotypes. These experiments not only defined different t-lethal mutations as non-allelic but showed that several are in very close physical association with the H-2 locus, which is itself transposed or inverted to an anomalous position in t-haplotypes. This information led to restriction enzyme mapping that showed the molecular structure of all t-haplotypes to be much more similar to one another than wild type chromosomes are to one another. Future experiments will include chromosomal walking with cloned DNA from t-haplotypes to further define their structure.

39405 **Physical mapping of homologous segments of mitochondrial episomes from S male-sterile maize.** Kim, B.D. (Univ. of Florida, Gainesville); Mans, R.J.; Conde, M.F.; Pring, D.R.; Levings, C.S. III. *Plasmid;* 7: 1-14(1982).

Restriction endonuclease maps of two double-stranded plasmid-like DNAs, 6180 and 5175 bp each, isolated as linear molecules from the mitochondria of S-type cytoplasmic male-sterile maize were prepared. Twelve cleavage sites were mapped in each using HindIII, XhoI, EcoRI, SacI, XbaI, SalI, BamHI, and BstEII. BamHI does not cleave S-1 DNA and SalI does not cleave S-2 DNA. A 1150-bp homologous sequence in addition to the 200-bp terminal inverted repeats was terminally oriented on both DNAs by reciprocal hybridization and heteroduplex analysis.

## 5505 Metabolism

*REFER ALSO TO CITATION(S) 39402*

39406 **(BNL—33155) Carbon budgets in symbiotic associations.** Muscatine, L.; Falkowski, P.G.; Dubinsky, Z. (California Univ., Los Angeles (USA). Dept. of Biology; Brookhaven National Lab., Upton, NY (USA); Bar-Ilan Univ., Ramat-Gan (Israel). Dept. of Life Sciences). 1983. Contract AC02-76CH00016. 10p. (CONF-830490—1). NTIS, PC A02/MF A01. Order Number DE83013624.

From 2. international colloquium on endocytobiology; Tubingen, F.R. Germany (10 Apr 1983).

Methods are described which permit the estimation of daily budgets for photosynthetically fixed carbon in any alga-invertebrate symbiosis. Included is a method for estimating total daily translocation which does not involve the use of C-14. A daily carbon budget for a shallow water symbiotic reef coral is presented.

## 5506 Medicine

*REFER ALSO TO CITATION(S) 39220, 39421, 39423, 39434, 39445, 39450*

39407 **(ORNL/CSD—111) Nonparametric estimation of the distribution of time to onset for specific diseases in survival/sacrifice experiments.** Turnbull, B.W.; Mitchell, T.J. (Oak Ridge National Lab., TN (USA)). Jul 1983. Contract W-7405-ENG-26. 41p. NTIS, PC A03/MF A01. Order Number DE83013726.

We consider the analysis of an animal survival/sacrifice experiment in which it is desired to investigate the incidence of a particular disease of interest. It is assumed that the disease is irreversible and detectable only at death, e.g., via a necropsy. Each observation can be of one of three types, namely, death caused by the disease, death by competing cause (e.g., sacrifice) with the disease present, and death with the disease absent. A two-dimensional EM algorithm is proposed to obtain the nonparametric maximum likelihood estimates of the distribution G(t) of the time to onset (Y) and the distribution F(t) of the time to death (X) from the disease. A slight modification of the algorithm enables the construction of likelihood based confidence intervals of F(t), G(t), the medians of X and Y and other functions of interest. The methods are illustrated using data from an experiment with laboratory mice in which the disease of interest is reticulum cell sarcoma.

39408 **Proteins of human urine. II. Identification by two-dimensional electrophoresis of a new candidate marker for prostatic cancer.** Edwards, J.J. (Argonne National Lab., IL); Anderson, N.G.; Tollaksen, S.L.; von Eschenbach, A.C.; Guevara, J. Jr. *Clinical Chemistry (Winston-Salem, North Carolina);* 28: No. 1, 160-163(1982). Contract W-31-109-ENG-38.

A protein series common to the urine and prostatic tissue of 16 of 17 patients with prostatic adenocarcinoma has been identified by high-resolution two-dimensional gel electrophoresis. These proteins, designated PCA-1, have a relative molecular mass in sodium dodecyl sulfate of about 40,000. Analyses of urines from eight age-matched controls, seven patients with other types of urogenital malignancies, two patients with benign prostatic hyperplasia, and five patients with malignancies not associated with the urogenital system failed to show PCA-1 in the patterns. These preliminary findings suggest that this protein should be systematically investigated as a candidate marker for prostatic adenocarcinoma in man.

## 5507 Microbiology

*REFER ALSO TO CITATION(S) 38593, 38673, 38674, 39417*

## 5508 Morphology

39409 **(CONF-830557—3) Biometric estimation of chest wall thickness of female radiation workers as an aid in in-vivo detection of the actinides.** Lane, B.H.; Berger, C.D. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE83012599.

From ORNL workshop on calibration of actinide lung counters; Oak Ridge, TN, USA (10 May 1983).

An equation was derived to estimate female chest wall thickness from a series of biometric measurements. This technique will result in improved performance for actinide detection in females by accounting for variations in chest wall thickness in derivation of calibration factors.

## 5509 Pathology

*REFER ALSO TO CITATION(S) 39393*

## 5530 Agriculture And Food Technology

*REFER ALSO TO CITATION(S) 39394*

39410 **(IAEA-R—1804-F) Nitrogen fixation by free-living microorganisms in tropical rice soils using labelled fertilizer. Part of a coordinated programme on isotope techniques in studies of biological nitrogen fixation for the dual purpose of increasing crop production and decreasing nitrogen fertilizer use to conserve the environment. Final report for the period 1 June 1976-31 August 1981.** Rao, V.R. (International Atomic Energy Agency, Vienna (Austria)). Nov 1981. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702060.

Both acetylene-reduction and $^{15}N$ techniques were used to study heterotrophic N fixation in the rhizosphere of rice plants.

Soils subjected to flooding in 4 soil types in both greenhouse and the field were found to stimulate greater heterotrophic nitrogen fixation than moist soils. The addition of organic materials, in particular, cellulose and rice straw, in general, enhanced nitrogen fixed by heterotrophic organisms living in the rhizosphere of rice plants. The highest amount of N fixed was 38 kg N/ha, and was obtained in a flooded lateritic soil to which had been added cellulose. Heterotrophic nitrogen fixation was influenced by soil type. In this study, the lowest value for fixed N was recorded in an acid sulphate soil of low pH. The addition of increasing amounts of inorganic nitrogen fertilizer in the form of ammonium sulphate suppressed rhizospheric nitrogen fixation in all soils, but the extent of suppression differed in the different soils. Benomyl fungicide and methyl carbamate insecticide had a stimulatory effect on heterotrophic nitrogen fixation in soils under rice roots. Different rice cultivars stimulated strains of Azospirillum to varying extent, and thus did not fix nitrogen to the same extent. It is thus possible that varieties of rice could be selected on the basis of their ability to support non-symbiotic N fixation in their rhizosphere.

39411 **(IAEA-R—2500-F) Isotope studies on rainfed rooting characteristics and efficient use of applied fertilizer on cassava. Final report for the period 1 December 1979-30 April 1981.** Chaiwanakupt, S. (International Atomic Energy Agency, Vienna (Austria)). Nov 1981. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702063.

Soil injection of $^{32}P$ was used to determine the root activity pattern of rainfed Cassava (Manihot esculenta, Crantz) in Thailand. Root activity decreased with depth so that 57, 38 and 5 percent of the total activity was noted at the 15, 30 and 50 cm depths, respectively. The root activity increased with distance from the plant. Twenty two, 28 and 50 percent of the root activity was obtained at the 10, 20 and 30 cm distances, respectively. It was thus concluded that phosphorus fertilizer should be mixed with the surface 15 cm soil 30 cm from Cassava rows to maximize fertilizer uptake.

39412 **(N—8315790) Remote Sensing Program.** Philipson, W.R.; Liang, T.; Philpot, W.D. (Cornell Univ., Ithaca, NY (USA)). Jan 1983. 261p. (E—83-10120; NASA-CR—169723). NTIS, PC A12/MF A01.

Field spectroradiometric and airborne multispectral scanner data were related to vineyard yield and other agronomic variables in an attempt to determine the optimum wavelengths for yield prediction modeling. Reflections between vine canopy reflectance and several management practices were also considered. Spectral analysis of test vines found that, although some correlations with vine yield were significant, they were inadequate for producing a yield prediction model. The findings also indicate that the vines examined through the field spectroradiometers were not truly representative. Geologic linears identified from aerial photographys, LANDSAT images, and maps were compared to gas well locations in three New York' counties. Correlations were found between the dominant trends in regional liners and gas field boundaries and trends. Other projects being conducted under the grant include determining vegetable acreage in mucklands, site selection for windmills, spectral effects of sulfur dioxide, and screening tomato seedlings for salt tolerance.

# 56 BIOMEDICAL SCIENCES, APPLIED STUDIES

39413 **(SSA—1982-TS-3) 1981 scientific works.** (Centre de Recherches du Service de Sante des Armees, 75 - Paris (France)). 1982. 486p. (In French). NTIS (US Sales Only), PC A21/MF A01. Order Number DE83750895.

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Individual papers are abstracted separately for the data base.

## 5601 Radiation Effects

*REFER ALSO TO CITATION(S) 38519, 38519, 38551, 38569, 38575, 39217, 39309, 39396, 39409*

39414 **(ABCC—14-63) ABCC-JNIH pathology studies: Hiroshima and Nagasaki. Report 1, October 1950-September 1962.** Angevine, D.M.; Jablon, S.; Matsumoto, Y.S. (Atomic Bomb Casualty Commission, Nagasaki (Japan)). 1962. Contract AC01-76EV03161. 58p. (In English and Japanese). NTIS, PC A04/MF A01. Order Number DE83902244.

Portions are illegible in microfiche products.

A sample of 100,000 persons in both Hiroshima and Nagasaki was constructed to serve as the basis for the JNIH-ABCC Life Span Study. A subsample of 20,000 is the basis for the ABCC-JNIH Adult Health Study. The third element, the pathology program was instituted to endow the autopsy program with the high degree of statistical control characterizing the Life Span and Adult Health studies. A study of the autopsy series (1215 cases) was made to: (1) determine how adequately the more recent cases meet the expectations with respect to age, sex, city, and distance from the hypocenter, and to determine whether any of the original bias still exists and if so, to what extent; (2) ascertain the degree of correlation between death certificate diagnoses and the autopsy anatomic diagnoses; and (3) determine what effect, if any, the degree of exposure to radiation may have had upon different disease groups, with special emphasis on various maligmant tumors. (ACR)

39415 **(BNL—33085) Alternative interpretations of statistics on health effects of low-level radiation.** Hamilton, L.D. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 48p. (CONF-8210139—2). NTIS, PC A03/MF A01. Order Number DE83013273.

From 7. symposium on statistics and the environment; Washington, DC, USA (4 Oct 1982).

Four examples of problems in alternative interpretation of statistics of data on low-level radiation are reviewed: (1) post-hoc analysis and aggregation of data leading to faulty conclusions in the re-analysis of genetic effects of the atomic bomb, and premature conclusions on the Portsmouth Naval Shipyard data; (2) inappropriate adjustment for age and ignoring differences between urban and rural areas leading to potentially spurious increase in incidence of cancer at Rocky Flats; (3) summary statistics based on ill-conditioned individual rates leading to a possibly spurious association between childhood leukemia and fallout in Utah; and (4) preliminary work published with inadequate consideration of epidemiological problems associated with the methods used - censored data - leading to inappropriate conclusions, needless alarm at the Portsmouth Naval Shipyard, and diversion of scarce research funds.

39416 **(CONF-830556—5) Dominant-lethal mutations and heritable translocations in mice.** Generoso, W.M. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 33p. NTIS, PC A03/MF A01. Order Number DE83012656.

From International workshop on the principles of environmental mutagenesis, carcinogenesis, and teratogenesis; Shanghai, China (25 May 1983).

Chromosome aberrations are a major component of radiation or chemically induced genetic damage in mammalian germ cells. The types of aberration produced are dependent upon the mutagen used and the germ-cell stage treated. For example, in male meiotic and postmeiotic germ cells certain alkylating chemicals induce both dominant-lethal mutations and heritable translocations while others induce primarily dominant-lethal mutations. Production of these two endpoints appears to be determined by the stability of alkylation products with the chromosomes. If the reaction products are intact in the male chromosomes at the time of sperm entry, they may be repaired in fertilized eggs. If repair is not effected and the alkylation products persist to the time of pronuclear chromosome replication, they lead to chromatid-type aberrations and eventually to dominant-lethality. The production of heritable translocations, on the other hand, requires a transformation of unstable alkylation products into suitable intermediate lesions. The process by which these lesions are converted into chromosome exchange within the male genome takes place after sperm enters the egg but prior to the time of pronuclear chromosome replication (i.e., chromosome-type). Thus, dominant-lethal mutations result from both chromatid- and

chromosome-type aberrations while heritable translocations result primarily from the latter type. DNA target sites associated with the production of these two endpoints are discussed.

39417 **(DOE/EV/03419—T3) Studies on factors affecting herpesvirus-induced cell fusion. Final report.** Person, S. (Pennsylvania State Univ., University Park (USA). Dept. of Biochemistry, Microbiology, Molecular and Cell Biology). May 1983. Contract AC02-76EV03419. 7p. (COO—3419-24). NTIS, PC A02/MF A01. Order Number DE83012395.

The research supported by this grant can be divided into two general areas: biological effects of radioactive decay of $^3$H-labeled compounds in microorganisms and studies on cell fusion induced by Herpes Simplex virus type 1 (HSV-1). The first mentioned studies included a careful evaluation of the chemical effects associated with the decay of $^3$H-labeled compounds following their incorporation into macromolecules of viruses and bacteria. The most interesting parameters measured were mutation production, cross-linking of DNA, and single-strand breaks of DNA. The research on cell fusion induced by HSV-1 has been largely phenomenological. Initially we developed quantitative and reproducable assays for cell fusion. One measured the rate of survival of single (non-fused) cells using a Coulter counter. A second assay employed fluorescent enhancement due to energy transfer between two dyes, fluorescein and rhodamine. We have isolated and begun to characterize a number of virus mutants that cause an increased amount of cell fusion. Most recently this analysis has been extended to physical mapping of the mutants with cloned restriction endonuclease fragments of HSV-1.

39418 **(DOE/EV/03490—2284) Mechanisms of uv mutagenesis in yeast and E. coli.** Lawrence, C.; Christensen, R.; Christensen, J.R.; O'Brien, T. (Rochester Univ., NY (USA)). 1983. Contract AC02-76EV03490. 10p. (CONF-830440—4). NTIS, PC A02/MF A01. Order Number DE83013219.

From UCLA symposia on molecular and cellular biology; Keystone, CO, USA (10 Apr 1983).

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Experiments investigating ultraviolet light mutagenesis in either bakers' yeast, Saccharomyces cerevisiae, or E. coli have led to the following conclusions. First, cyclobutane pyrimidine dimers cause most mutations in both organisms; pyrimidine adducts, such as PyC, can account at best for only a small proportion. 86 percent of forward mutations induced at the E. coli lacI locus can be abolished by photoreactivation under conditions which do not alter the level of recA induction. About 75 percent of the forward mutations induced at the CAN1 locus of yeast could be removed by photoreactivation, a value that lies within the range observed previously for the reversion of CYC1 alleles (60 percent - 97 percent). Second, about 10 percent of the lacI forward mutations are untargeted, a smaller fraction than found previously for cycl-91 reversion in yeast. It is not yet clear whether the two species are really different in this respect, of whether the cycl-91 reversion site is a typical of the yeast genome at large. Third, analysis of reversion frequencies of 20 mutant alleles suggests that about 10 to 25 percent of all replication errors produced by mutagenic mechanisms in uv-irradiated yeast involve additions or deletions of base-pairs, indicating that error-prone repair does not just produce substitutions. Last, the REV1 locus in yeast is concerned with the induction of frameshift mutations at some, but not all, genetic sites, just as found previously for substitution mutations. The function of the REV3 gene is more widely, though not universally, required while the function of the RAD6 gene, like that of the recA locus in E. coli, appears to be necessary for all kinds of uv mutagenesis. E coli genes comparable to REV1 and REV3 have not yet been described; conversely, there does not yet appear to be a yeast equivalent of umuC.

39419 **(DPR—82-3) Assessment of the dose equivalents delivered by the main radionuclides involved in the operation of nuclear plants.** Menoux, B.; Beau, P.G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). 1982. 50p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702053.

The internal exposure of workers is characterized by an exposure of the body protracted after the intake. In order to describe this exposure in term of likely potential detriment, ICRP has defined two concepts in its publications 26 and 30: 1/ Committed dose to organs and tissues associated to a limit for non stochastic effects and 2/ Effective committed dose to the whole body associated with a limit for stochastic effects. Dose equivalents have been calculated after these concepts for 38 radionuclides; they are expressed as a function of the intake route for a unit concentration per second in inhaled air and for a unit ingested activity. Two kinds of factors are considered in the assessment of the delivered doses. The physiological and metabolic factors are quantified in models describing the radionuclide behaviour in the body as a function of their physical form and their physico-chemical nature. The dosimetric factors are concentrated in the formulation of the effective specific energy which considers the concept of source organ and target organ. Particular calculations have been made for radionuclides in the gaseous state in order to take into account the complex exposure involved.

39420 **(IAEA-R—1525-F) Evolution of insect pest and disease resistant, high-yielding and improved quality varieties of cotton by use of ionizing radiation. Part of a coordinated programme on the use of induced mutations for disease resistance in crop plants. Final report for the period 15 October 1974-30 June 1981.** Vasti, S.M. (International Atomic Energy Agency, Vienna (Austria)). Jun 1981. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702064.

Disease resistant, high yielding and higher quality cotton varieties were developed. 42 interspecific hybrid progenies of earlier crosses between Gossypium barbadense and Gossypium tomentosum or Gossypium barbadense and Gossypium hirsutum were included. Out of these, 22 progenies in $F_3$ generation were irradiated by gamma radiation doses of 20 and 25 kR. A list is given of interspecific hybrid progenies, as are the lists of boll rot susceptible and resistant plants in the irradiated and non-irradiated populations and/or successful crosses made between 1977 and 1978.

39421 **(IAEA-R—1773-F) Non-invasive procedures to measure tumour cell turnover in solid tumours treated with radiation and radiosensitizers. Coordinated programme on improvement in radiotherapy of cancer using modifiers of radiosensitivity of cells. Final report for the period 1 April 1976-30 November 1981.** Feinendegen, L. (International Atomic Energy Agency, Vienna (Austria)). Jan 1982. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83702051.

Whole-body irradiation of mice causes the dose-dependent appearance of a humoral factor in blood serum which inhibits incorporation of 125-iodo-deoxyuridine (125-IUdR) into tissue culture cells. This factor appears even at doses below 0.01 Gy gamma irradiation and thus is probably not related to cell death. Data are presented relating this humoral factor to thymidine. In an attempt to optimize the chemotherapeutic treatment of mouse tumor sarcoma-180, liposomes containing cis-dichlorodiammine-platinum II (PDD), having transition temperatures a few degrees higher than the rectal temperature of mice, were used in combination with local hyperthermia. The uptake of radioactive PDD by tumors heated for 1 hour at 42° was almost four-fold greater when the drug was associated in liposomes than if administered as free drug. The effect of various combinations of hyperthermia, drug-containing liposome and free PDD on tumor growth was also studied. Treatment wit.. liposome associated PDD plus local heating resulted in a dose-modifying factor of 7 when compared with free drug and no hyperthermia. The mode of action of the antitumor agent PDD was also studied in vivo either alone or in combination with ionizing radiation on a solid experimental murine tumor. The effects were assayed in vivo by volumetric measurements, in addition 125-IUdR was used for tracing DNA precursor incorporation. Activity loss from euoxic and average tumor cells was evaluated with a double tracer technique. PDD is a potent adjunct to therapy with different LET radiation causing distinct effect in euoxic and hypoxic cells.

39422 **(IAEA-R—1777-F) Clinical and laboratory assessment of a combination of drugs with radiation. Coordinated programme on improvement in radiotherapy of cancer using modifiers of radiosensitivity of cells. Final report for the period 15 March 1976 - 30 November 1981.** Bleehen, N. (International Atomic Energy Agency, Vienna (Austria)). Jan 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702052.

Applications were clinically studied of misonidazole (MISO) as a hypoxic cell radiosensitizer with pharmacokinetic studies. Work with desmethylmisonidazole was focused on its penetration into the CNS because its low lipophilicity would predict poorer access than MISO. Laboratory work was focused on the interaction of hyperthermia with drugs. Cytotoxicity of MISO induced by hyperthermia was studied. Heat response following hypoxic pretreatment with MISO of EMT6 spheroids showed marked enhancement of subsequent heat killing dependent on the duration of the hypoxic pretreatment. The effect was studied in vitro of preheat temperature at modest temperatures (39 to 43°C) on thermal tolerance and subsequent hyperthermic (43 to 44°C) interaction with bleomycin, adriamycin and BCNU. Interaction between several cytotoxic drugs and two potentially critical normal tissues, skin and bone marrow was studied in the mouse. No increase in the heat reaction in the skin of the mouse foot was observed following single injections of adriamycin, bleomycin or 5 daily doses of bleomycin together with a single heat treatment. Single doses of BCNU and CTX increased the heat reaction. The radioprotector WR2721 failed to protect against either the heat or heat drug reactions from CTX and BCNU.

39423 **(IAEA-R—1781-F) Radiation sensitizations at DNA-level by chemical and biological agents. Coordinated programme on improvement of radiotherapy of cancer using modifiers of radiosensitivity of cells. Final report for the period 1 April 1976 - 30 November 1981.** Altmann, H. (International Atomic Energy Agency, Vienna (Austria)). Jan 1982. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702049.

Radiation sensitization by chemical agents at DNA level is discussed. Procaine, Halothan and Metronidazole showed no significant effect on unscheduled DNA synthesis (UDS) in mouse spleen cells, investigated by autoradiography and no effect on rejoining of DNA single strand breaks after gamma or UV irradiation. Oxyphenbutazon and prednisolone reduced the replicative DNA synthesis in vitro and in vivo but there was only little effect on DNA repair in the in vivo experiments. These two substances showed also a small reduction in poly(ADP-ribose) synthesis (PAR synthesis). 5-methoxypsoralen (5-MOP) and 8-methoxypsoralen (8-MOP) in combination with UV irradiation showed that 5-MOP was more toxic than mutagen, but induced much less DNA crosslinks than 8-MOP. Autoradiographic studies of radiation sensitization by biological agents showed significant inhibition of UDS in Yoshida tumor cells after acute mycoplasma infection in rats. Nucleoid sedimentation studies showed only in the case of Yoshida tumor cells after mycoplasma infection a dramatic effect in the sedimentation behaviour. Sensitization of cells by changing chromatin structure was also studied. Benzamide, 3-$NH_2$-benzamide, 3-Methoxybenzamide, Spermine, Theophyllin and Caffeine were tested in different concentrations on replicative DNA synthesis, UDS after UV irradiation and PAR synthesis Chinese hamster ovary cells. 5-Methoxybenzamide was the strongest sensitizer and inhibitor of the PAR synthesis, and was used in further experiments. Results of KFA Juelich on sensitization of a mamma-adenocarcinoma EO 771 on C57 Bl mice are given. Replicative DNA synthesis, DNA repair and PAR synthesis were compared in spleen cells and adenocarcinoma cells after treatment with 5-Methoxybenzamide. An inhibitory effect on UDS could be shown only in adenocarcinoma cells but not in the mice spleen cells.

39424 **(IAEA-R—2408-F) Studies on control of yellow stem borer, Tryporyza incertulas, a serious pest of paddy. Part of a coordinated programme on the use of pest management with emphasis on rice insects. Final report for the period 15 July 1979-30 November 1981.** Rahalkar, G.W. (International Atomic Energy Agency, Vienna (Austria)). Mar 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702065.

Egg parasitism is the chief biotic factor regulating paddy stem borer populations. However, effective suppression of the borer through their natural enemies is not evident in practice. Studies were undertaken to evaluate the feasibility of releasing sterile yellow stem borer females into the field to increase host egg densities as these females would lay nonviable eggs. (a) Paddy fields were surveyed for the incidence of egg parasitism. (b) Attempts were made to rear yellow stem borer larvae on cut stem pieces of field grown rice plants. (c) Trichogramma japonicum, the natural egg parasite of the stem borer was reared in the laboratory using eggs of Corcyra cephalonica and Ephestia cautella as alternate host material. Mass rearing of yellow stem borer larvae on paddy plants grown under laboratory conditions does not appear practically feasible. Borer larvae reared on cut stem pieces with intact roots did not yield satisfactory adults as far as their reproductive behaviour was concerned. Though some of the dietary compositions contained natural host material, they failed to support the larval establishment. Probably some highly specific phagostimulants need to be incorporated in the diets. T. japonicum could be reared on radiation killed Ephestia eggs. The female parasite was unable to discriminate between eggs laid by radiation sterilized host females and those laid by normal ones.

39425 **(IAEA-R—2495-F) Genetic toxicological evaluation of rats fed on diet containing salted, dried and irradiated mackerel. Part of a coordinated programme on radiation preservation of dried fish indigenous to Asia. Final report for the period 1 December 1979-30 November 1980.** Chauhan, P.S. (International Atomic Energy Agency, Vienna (Austria)). May 1982. 58p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702066.

An assessment of genotoxicity of salted and dried mackerel irradiated with 2 kGy was carried out by dominant lethal assay in mice, bone marrow micronucleus test in mice and bone marrow metaphase analysis in rats. No evidence of induced dominant lethality was observed in mice fed on irradiated mackerel. Similarly, no evidence of chromosomal damaging effects in rats and mice and no spindle effects in mice fed on nutritional adequate diet containing irradiated mackerel could be observed.

39426 **(IAEA-R—2615-F) Sprout inhibition in garlic (Allium sativum) and onion (Allium cepa L.) by gamma irradiation. Part of a coordinated programme on pre-commercial scale radiation treatment of food. Final report for the period 1 November 1980-31 October 1981.** Curzio, O.A. (International Atomic Energy Agency, Vienna (Austria)). Apr 1982. 26p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702067.

With the aim of verifying the possibilities and circumstances of sprout inhibition and storage life extension of onion and garlic by gamma irradiation, onion bulbs of variety Valenciana Sintetica 14 and garlic bulbs of a coloured locally grown variety were subjected to irradiation with 3 Krad of $^{60}Co$ gamma rays. The dose rate was 2440 rad/min; the irradiation conditions warranted a Dsub(max)/Dsub(min) ratio of 1.25. The irradiated bulbs and control samples of non-irradiated bulbs were investigated for a period of 270 to 330 days. Weight loss, external and internal sprouting, signs of decay, and the percentage of commercial bulbs were observed with the following results. Weight loss was found to be less in irradiated bulbs than in controls - 22% against 40% for onion and 33% against 65% for garlic. The dose of gamma radiation employed was proved to be sufficient for sprout inhibition in both species and for partial inhibition of decay and softening. The aroma of garlic was not impaired by irradiation. For both products, gamma irradiation was found to prolong the period of commercial utilizability.

39427 **(IAEA-TECDOC—255) Estimation of environmental transfer of plutonium and the dose to man.** (International Atomic Energy Agency, Vienna (Austria)). Sep 1981. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702057.

The need to examine the behaviour of individual radionuclides in the environment is stressed. Sometimes unique pathways of exposure exist and more specialized methods of dose estimation could be considered. The toxicity of the alpha emitting plutonium

isotopes is of concern and their long half-lives lead to persistence in the environment and long-term potential for exposing man. Some formulas are therefore presented for making preliminary estimates of environmental transfer and dose for the radioisotopes of the element plutonium. Exposure of man to plutonium in the environment may occur by inhalation or ingestion - the inhalation and ingestion intake rates for which specific pathways have been considered are listed. The primary pathway to man is the inhalation intake; the most important ingestion intake is the consumption of plant foods due to the greater concentration achieved and the higher consumption rates of these foods. Also discussed is plutonium in the nuclear fuel cycle, the release of plutonium from current nuclear installations, the occurrence of plutonium from weapons fallout, airborne releases of plutonium (concentration in the air, deposition rate, resuspension, transfer to plants - foliar and root uptake - transfer to milk, etc.), liquid release (concentration in water, transfer to drinking water, to fish, to plants by irrigation, to milk, to meat). The importance of the release situation and local environment conditions including land and water utilization, population factors and habits for any further investigation is pointed out.

39428 (IAEA-TECDOC—256, pp 43-65) **Studies on wholesomeness of irradiated shrimp and carp.** Hossain, M.M.; Amin, M.R.; Matin, M.A. (Atomic Energy Centre, Dacca (Bangladesh)). Nov 1981. NTIS (US Sales Only), PC A09/MF A01.

In Wholesomeness of the process of food irradiation. Final report of the co-ordinated research programme by the Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development.

Three different mutagenicity screening tests and two subchronic toxicity studies were carried out to investigate toxicological safety of irradiated shrimp and carp fed to mice and rats. No indications of mutagenicity were observed when irradiated shrimp or irradiated carp diets were fed to mice for dominant lethal mutation or when mice were used as host animals for Salmonella typhimurium G-46 in the host-mediated assay. Micronucleus test which was used to further study possible mutagenic effects of irradiated fish did not reveal any such effects in the bone marrow cells of rats. The results of sub-chronic toxicity tests in mice and rats fed irradiated carp and shrimp respectively did not indicate any deleterious effect on growth, food intake and behaviour during the three months' observation period. On necropsy, vital organs of the animals were found to be free of toxic effects. The weights of the organs and histopathological examinations of the organs did not reveal any possible toxic effect due to feeding of irradiated fish.

39429 (IAEA-TECDOC—258) **Revision of the recommended international general standard for irradiated foods and of the recommended international code of practice for the operation of radiation facilities used for the treatment of foods. Report of a consultation group jointly organized by the FAO, IAEA and WHO and held in Geneva, 1-3 July 1981.** (Food and Agriculture Organization of the United Nations, Rome (Italy); International Atomic Energy Agency, Vienna (Austria); World Health Organization, Geneva (Switzerland)). Nov 1981. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702068.

In view of the findings and statements of the Joint FAO/IAEA/WHO Expert Committee on the Wholesomeness of Irradiated Food, convened in Geneva from 27 October to 3 November 1980, a Consultation Group, convened in Geneva from 1 to 3 July 1981 suggested the revision of the Recommended International General Standard for Irradiated Foods and of the Recommended International Code of Practice for the Operation of Radiation Facilities. The proposed changes are given and justified and the revised wording of the documents presented.

39430 (JINR-R—19-82-255) **Effect of NaCl and KCl on irradiated cells of diploid yeasts.** Amirtaev, K.G.; Lobachevskij, P.N.; Lyu Gvan Son. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702050.

It is shown that holding of diploid yeast Saccharomyces cerevisiae in NaCl and KCl solutions causes the cell inactivation, the rate of which is greater in the case of γ-irradiated cells then in the case of unirradiated ones. The inactivation rate depends on dose and temperature of holding. It is suggested that this phenomenon is due to damage of mass structures of cells. It has been found that liquid holding recovery goes slower in KCl solution than in water and is totally inhibited in NaCl solution.

39431 (KFK—3434) **Increased radioresistance in spheroids of ionically coupled cells: Cytogenetic and biochemical investigations.** Hinz, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Genetik und Toxikologie von Spaltstoffen; Heidelberg Univ. (Germany, F.R.). Naturwissenschaftliche Gesamtfakultaet). Nov 1982. 72p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750676.

Aggregates (spheroids) of cultured mammalian cells, exposed to ionizing radiation, show an increased radioresistance compared to single cells (monolayer) provided that the cells can undergo intercellular communication via gap junctions. To characterize the phenomenon of 'contact resistance' (CR) further its effects on cell cycle kinetics, mutagenesis, chromosome damage and DNA-repair were investigated. Whereas the repair of DNA strand breaks remained unchanged, in all other tests CR reduced cytogenetic damage, irrespective of the proliferative status of the cell line used. Furthermore, CR could be induced in spheroids not yet resistant by activators of adenylate cyclase (e.g. prostaglandine $E_1$). However, no induction could be achieved in monolayers. Basal adenylate cyclase activity in different cell lines correlate with the activity of the gap junctions. This suggested that a regulation of this enzyme (and thereby of cAMP) might be mediated by the gap junctions. These properties of CR exhibit a remarkable analogy to processes associated with cytodifferentiation. Thus CR appears to be a basic property of three dimensionally organized tissues of communicating cells.

39432 (NRPB-DL—5) **Generalised derived limits for radioisotopes of plutonium.** Simmonds, J.R.; Harrison, N.T.; Linsley, G.S. (National Radiological Protection Board, Harwell (UK)). Jan 1982. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702058.

Generalised Derived Limits (GDLs) are evaluated for plutonium isotopes in materials from the terrestrial and aquatic environments and for discharge to atmosphere. They are intended for use as convenient reference levels against which the results of environmental monitoring can be compared and atmospheric discharges assessed. GDLs are calculated using assumptions concerning the habits and location of the critical group of exposed individuals in the population. They are intended for use when the environmental contamination or discharge to atmosphere is less than about 5% of the GDL. If the level of environmental contamination or discharge to the atmosphere exceeds this percentage of the GDL it does not necessarily mean that the dose equivalents to members of the public are approaching the dose equivalent limit. It is rather an indication that it may be appropriate to obtain a more specific derived limit for the particular situation by reviewing the values of the parameters involved in the calculation. GDL values are specified for plutonium radionuclides in air, water, soil, sediments and various foodstuffs derived from the terrestrial and aquatic environments. GDLs are also given for plutonium radionuclides on terrestrial surfaces and for their discharge to atmosphere.

39433 (NRPB-R—129) **Gut uptake factors for plutonium, americium and curium.** Harrison, J.D. (National Radiological Protection Board, Harwell (UK)). Jan 1982. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702055.

Data on estimates of the absorption of plutonium, americium and curium from the human gut based on measurements of uptake in other mammalian species are reviewed. It is proposed that for all adult members of the public ingesting low concentrations of plutonium in food and water, 0.05% would be an appropriate value of absorption except when the conditions of exposure are known and a lower value can be justified. For dietary intakes of americium and curium, the available data do not warrant a change from the ICRP value of 0.05%. For newborn children ingesting americium, curium

and soluble forms of plutonium, a value of 1% absorption is proposed for the first 3 months of life during which the infant is maintained on a milk diet. It is proposed that a value of 0.5% should be used for the first year of life to take account of the gradual maturation of the gut. In considering the ingestion of insoluble oxides of plutonium by infants, it is proposed that absorption is taken as 0.1% for the first 3 months and 0.05% for the first year.

39434 **(PB—83-175604) Calculation of dose and temperature increase at radiation with scanned continuous electron beam of objects which are propelled at a uniform rate of speed at right angles to the scanning direction.** Luthjens, L.H.; Hom, M.L.; Vermeulen, M.J.W. (Interuniversitair Reactor Inst., Delft (Netherlands)). 1970. 11p. NTIS, PC A02/MF A01.

On account of the small depth of penetration of 1-3 MeV electrons, a technique is used for the radiation of large objects--or, rather, large surfaces--whereby the electron beam is moved back and forth, or scanned, over a certain width, at the same time as the surface to be radiated is moved, at a uniform rate, at right angles to the scanning direction. Besides the radiation of a large surface, the scanning and the moving of the table have still another important function, viz., keeping the total energy absorbed locally per time unit low enough to avoid the development of too high temperatures, which would lead to damage to exit window of accelerator and the radiated object.

39435 **(PNL—4560) Pacific Northwest Laboratory plan to maintain radiation exposure as low as reasonably achievable (ALARA).** Higby, D.P.; Denovan, J.T. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 22p. NTIS, PC A02/MF A01. Order Number DE83013851.

This document describes the radiation safety program at the Pacific Northwest Laboratory (PNL). The practices and administrative policies of this program support the principles of ALARA (to maintain radiation exposure as low as reasonably achievable). This document also describes a program to establish safety goals at PNL to help ensure that operations are conducted according to ALARA principles.

39436 **Differential sensitivity to inactivation of NUR and NUR$^+$ strains of Escherichia coli at six selected wavelengths in the UVA, UVB and UVC ranges.** Webb, R.B.; Tuveson, R.W. (Argonne National Lab., IL (USA)). *Photochemistry and Photobiology;* **36**: No. 5, 525-530(Nov 1982).

The radiation response of stationary-phase cells of Escherichia coli strains RT4 (nur$^+$) and RT2(nur) was measured at 6 selected wave lengths between 254 and 405 nm. The relative response of the nur$^+$ and nur strains was almost the same at 254 and 290 nm. However, the differential sensitivity of the RT4 and RT2 strains (ratio of the initial $F_{37}$ values of the nur$^+$ to the nur strains) was 2.7 at 313 nm, 3.2 at 334 nm, 3.1 at 365 nm, and 2.3 at 405 nm. Thus, the fluence enhancing effect of the nur genotype extends over the wavelength range of approximately 300 to 420 nm. The substantial effect of nur at 313 nm strongly suggests that the increased sensitivity of the nur strain is the consequence of a repair deficiency that reduces the efficiency of mending DNA lesions produced by UVA (320-400 nm) and UVB (290-320 nm), but not UVC (200-290 nm) radiation.

39437 **Further studies on the absorption of actinide elements from the gastrointestinal tract of neonatal animals.** Sullivan, M.F.; Gorham, L.S. (Pacific Northwest Lab., Richland, WA (USA)). *Health Physics;* **43**: No. 4, 509-519(Oct 1982).

Plutonium retention was measured after intragastric administration to neonatal rats, dogs and swine. At 1 week after administration, substantially more of the actinide remained in swine and dog than in rats. The quantity of $^{238}$Pu absorbed by piglets was markedly influenced by such factors as compound solubility, mass of plutonium administered, oxidation state of the actinide, and age of the animal at gavage. Cortisone treatment reduced absorption, but was less effective in piglets than in neonatal rats. Measurements of $^{238}$Pu transport from ligated segments of the neonatal swine intestine indicated highest absorption from the duodenum, where the actinide was shown, autoradiographically, to be deposited in the epithelial region; in the ileum, deposition was predominantly in the lacteal region. Absorption of actinides by neonatal swine decreased in the order of $^{233}$U> $^{238}$Pu> $^{237}$Np> $^{244}$Cm> $^{241}$Am. Measurements at 1 yr after gavage showed a much higher retention by swine than by rats.

39438 **Investigation of radionuclide concentrations in tissues of elk utilizing Los Alamos National Laboratory land.** Meadows, S.; Salazar, J. (Los Alamos National Lab., NM (USA)). *Health Physics;* **43**: No. 4, 595-598(Oct 1982).

Jemez mountain elk, which are hunted annually and utilise land belonging to Los Alamos Lab, were studied to investigate the concentration of radionuclides in their tissues, as these animals may be a potential pathway of environmental contamination in humans. Tissue samples of 10 elk from five geographic areas were collected and were counted on a Ge(Li) detector linked to a multi-channel analyzer. Results indicate that radionuclide concentrations in the various tissues do not differ where radioactivity is above natural fallout, although the concentration of $^{90}$Sr is higher. The radiation dose to consumers of elk meat from the Los Alamos lands would be negligible.

39439 **Uranium in drinking waters : rejection by human body.** Somayajulu, B.L.K.; Meghani, C.A.; Borole, D.V. (Physical Research Lab., Ahmedabad (India)). pp 528-532 of Management of environment [a felicitation volume presented to Dr A.K. Ganguly]. Patel, B. (ed.) (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). New Delhi, India; Wiley Eastern (1980).

Drinking water samples from tube wells in different localities of Ahmedabad and nearby industrial area (Naroda) were analysed for uranium. Stools, urine and blood samples were also analysed to determine whether uranium which enters the human system through drinking water is retained or excreted from the human system. Uranium concentration has been found to be in the range of 13.6 to 20.6 μg/l which is considerably higher than uranium concentration in drinking water from other regions of India (in the range 0.3 to .5 μg/l). The Ahmedabad individual has been found not to concentrate U in his body to any significant extent.

## 5603 Chemicals Metabolism And Toxicity

*REFER ALSO TO CITATION(S) 38386, 38430, 38431, 38433, 38434, 39349, 39351, 39410, 39416*

39440 **(DOE/EV/03490—2301) Toxicology of monofluorophosphate (MFP).** Smith, F.A.; Hodge, H.C. (Rochester Univ., NY (USA). Dept. of Radiation Biology and Biophysics; California Univ., San Francisco (USA). School of Medicine). 1983. Contract AC02-76EV03490. 15p. (CONF-830648—1). NTIS, PC A02/MF A01. Order Number DE83013010.

From International conference on monofluorophosphate; Boston, MA, USA (9 Jun 1983).

The toxic effects of $Na_2PO_3F$ are attributable to the fluoride ion released by the in vivo hydrolysis of the parent compound. The monofluorophosphate ion appears to play no role. The acute toxicity of $Na_2PO_3F$ is somewhat less than that of NaF, due to the lesser availability of fluoride in the short term from $Na_2PO_3F$. In the long term, $Na_2PO_3F$ produces virtually the same picture of renal effects and skeletal storage of fluoride as does NaF.

39441 **(IAEA-R—2088-F) Study of some nitrogen transformation reactions as influenced by the agrochemicals in some soils of north Iraq by using labelled compounds. Part of a coordinated programme on isotopic-tracer-aided studies of agrochemical residue - soil biota interactions. Final report for the period 1 October 1977-30 June 1982.** Shali, K.G. (International Atomic Energy Agency, Vienna (Austria)). Jun 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702061.

The effect is described of different pesticides when applied to autoclaved soils to which the mixture of nitrifier, ammonifier, and azotobacter were added and incubated for 90 days. The results

are given of the respiration parameter of $^{14}CO_2$ evolved at 30 and 60 days of incubation from soil samples obtained at depths of 15, 30, 45, and 60 cm. Graphs show the survival of mixture of nitrifier, ammonifier, and azotobacter treated with pesticides Benlate, Sevin, and Diptrex at three dose levels. Total bacterial counts as estimated by $^{14}C$-glucose oxidation are also shown.

**39442 (IAEA-R—2153-F) Tracer-aided studies on the fate and effects of sulphur dioxide in Spinacia oleracea L. and Triticum vulgare. Part of a coordinated programme on isotopic-tracer-aided studies of atmospheric sulphur pollutant - plant interactions. Final report for the period 1 March 1973-31 May 1982.** Plesnicar, M. (International Atomic Energy Agency, Vienna (Austria)). Jun 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702062.

Wheat, Triticum vulgare and spinach, Spinacia oleracea plants were exposed to two different concentrations of $^{35}SO_2$ - released by lactic acid from $Na_2{}^{35}SO_3$ - for 45 minutes, and distribution of radioactivity was studied in leaves, stem and roots. After 24 hours, the specific activity of the leaves of both plants was reduced while that of the roots was increased, suggesting $^{35}S$ translocation from leaves to roots. Translocation to the stem and roots of $^{35}S$ products was much higher in wheat than in spinach. In leaves of both plant species, ethanol-soluble products were much higher than the ethanol-insoluble fraction during the first 6 hours of exposure. The ethanol-soluble fraction contained sulphate, sulphite and unidentified material. The study suggests that $SO_2$ is metabolized in preference to endogenous S, that the wheat plant is more susceptible to $SO_2$, and that tolerance is related to the capacity of converting $SO_2$ to sulphate and reducing its further conversion. Uptake of $^{35}SO_2$ by young and old wheat and spinach plants was studied with a view to determining susceptibility to $SO_2$ exposure as a function of the developmental stage of the plant. In wheat, young plants metabolize endogenous sulphur in preference to absorbed $SO_2$ while older plants are active in converting absorbed sulphur into organic (ethanol-insoluble) form. In spinach, young plants are more active in transporting $^{35}S$ products from leaves to roots and older plants show higher incorporation percentage of $^{35}S$ into the organic fraction of leaves. Uptake of 1-$^{14}C$-acetate by lipids of leaf discs from spinach and wheat was investigated in normal and $SO_2$-stressed plants. The incorporation of radioacetate into lipids of leaf tissues of both plants was strongly inhibited in SO0 plants. Also U-$^{14}C$-lysine incorporation into proteins of leaf tissue was significantly inhibited by 0.2-2.0 ppm aqueous $SO_2$.

**39443 (INP—1102/C) Studies on the absorption and excretion of arsenic in test animals.** Mikulski, J.; Walczak, Z.; Politowski, M. (Institute of Nuclear Physics, Krakow (Poland)). 1980. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702054.

The partition of arsenous compounds in cats between blood, lymph and urine has been studied by the isotopic method. The rate of poison absorption from the intestinal tract and poison excretion with urine have also been investigated. It was found that arsenic is evenly distributed between blood and lymph, but its concentration in urine is about 100 times larger. The rate of arsenic absorption is very high - the absorption time is of the order of minutes and the absorption is shortly followed by the appearance of arsenic in urine.

**39444 (NUREG/CR—3133) Sensitivity of adult, embryonic, and larval crayfish Procambarus clarkii to copper.** Rice, D.W. Jr.; Harrison, F.L. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 25p. (UCRL—53048). NTIS, PC A02/MF A01 - GPO. Order Number DE83013269.

The copper sensitivity of adult, embryonic, and larval stages of the crayfish Procambarus clarkii was determined with flow-through bioassay methods. The P. clarkii adults, embryos, and larvae were exposed continuously to copper concentrations that ranged from those producing an immediate effect to those producing none. From the family of curves of cumulative mortality versus duration of exposure, median lethal times were determined and used to construct comparative toxicity curves. The 20-d (480-h) median lethal concentrations show the order of copper sensitivity of P. clarkii life-history stages: larvae (120 μg Cu/L) > adults (1300 μg Cu/L) > embryos (3700 μg Cu/L). In addition, comparisons in percent hatching were made between P. clarkii embryos exposed early and late during embryological development. Embryos exposed to copper concentrations as low as 250 μg Cu/L 600 h prior to hatching showed only 17% hatching, whereas embryos exposed to as high as 2840 μg Cu/L 250 h prior showed 100% hatching. Larvae exposed to copper as embryos were less sensitive than those exposed after hatching. Copper concentrations in adult crayfish tissues were analyzed. The remains of adult crayfish showed exposure-related increases in copper accumulation. The P. clarkii muscle, gill, liver, and kidney showed no dose-related increases in copper accumulation, though gills showed significant increases in copper accumulation at doses of 480 μg Cu/L and higher.

**39445 (ORNL/TM—8448/Rev.1) Biomedical and environmental sciences programs at the Oak Ridge National Laboratory.** Preston, E.L.; Barnes, D.S. (comps.). (Oak Ridge National Lab., TN (USA)). May 1983. Contract W-7405-ENG-26. 76p. NTIS, PC A05/MF A01. Order Number DE83013735.

The biomedical and environmental (BES) research programs provide information on environmental, health, and safety considerations that can be used to formulate and implement energy technology decisions. Research is directed at securing information required for an understanding of both the short- and long-term consequences of the processes involved in new energy technologies. This report discusses and describes the role, organizational structure, facilities, staff, recent accomplishments, and ongoing research programs of the BES program at ORNL. (ACR)

**39446 (PNL-SA—11346) State of research: biological pathways and food-chain transfer.** Vaughan, B.E. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC06-76RL01830. 42p. (CONF-830583—1). NTIS, PC A03/MF A01. Order Number DE83011380.

From American Association for the Advancement of Science annual meeting; Detroit, MI, USA (26 May 1983).

Data on the chemistry of biologically active components of petroleum, synthetic fuel oils, certain metal elements and pesticides provides valuable generic information needed for predicting the long-term fate of buried-waste constituents and their liklihood of entering food chains. Components of such complex mixtures partition between solid and solution phases, influencing their mobility, volatility, and susceptibility to microbial transformation. For PAH's and their hetero cycles, metabolites must be considered as potentially greater concerns than the parent compounds. Activity like mutagenicity of specific PAH's may also be blocked in the presence of complex mixtures. Recently, chemo-directed bioassays of synthetic-fuel oils have identified several new compound classes which are potent mutagens. Within food chains compound classes differ markedly in soil persistence, metabolizability, and tissue retention following depuration. Magnitude of these processes may contribute more to the outcome of organism exposure than compound toxicity based on simple bioassays.

**39447 (UCRL—89148) Laser dye toxicity, hazards, and recommended controls.** Mosovsky, J.A. (Lawrence Livermore National Lab., CA (USA)). 6 May 1983. Contract W-7405-ENG-48. 18p. (CONF-830584—1). NTIS, PC A02/MF A01. Order Number DE83011896.

From American industrial hygiene conference; Philadelphia, PA, USA (22 May 1983).

Laser dyes are complex fluorescent organic compounds which, when in solution with organic solvents, form a lasing medium. The wavelength of a dye laser's output beam can vary with different dyes, concentrations, and solvents, giving it a tunable feature capable of emitting ultraviolet, visible, or infrared radiation. Toxicity information on the approximately 100 commercially available laser dyes is very scarce. Limited animal experimentation has been performed with only a few dyes. This paper summarizes what is known about laser dye toxicity, and offers recommendations for controlling dye hazards. The laser dyes investigated have been categorized according to their central chemical structures. These include the xanthenes (rhodamines and fluoresceins), polymethines (cyanines and carbocyanines), coumarins, and stilbenes. A few other miscellaneous dyes that do not fall into one of these categories have also been investigated. Prepared laser dye solutions usual-

ly contain very small quantities of dye–typical dye concentrations are $10^{-2}$ to $10^{-5}$ molar. For this reason, the solvent in which the dye is dissolved plays an important role when defining potential hazards. Practically all the solvents used are flammable and toxic by inhalation and skin absorption, and therefore must be controlled properly.

39448 **Induction of 6-thioguanine-resistant mutations by rat-liver homogenate (S9)-activated promutagens in human embryonic skin fibroblasts.** Chen, D.J.C.; Okinaka, R.T.; Strniste, G.F.; Barnhart, B.J. (Los Alamos National Lab., NM). *Mutation Research;* **101**: 87-98(1982).

Most normal human fibroblasts grown in culture do not metabolize promutagens/procarcinogens. Thus screening assays employing normal human fibroblasts have only been successful for direct-acting chemical mutagens and various radiations. In this report a mutation assay (HGPRT locus) is described employing a normal human embryonic skin fibroblast and a rat-liver homogenate (S9) mixture. 3 model promutagens, benzo[a]pyrene (B[a]P), 3-methylcholanthrene (3MC), and dimethylnitrosamine (DMN) have been utilized in these studies. In addition to discussing conditions for optimizing the response of this assay, our results indicate that at constant amount of S9 protein concentration, there exists a linear correlation between mutagenicity and dose.

### 5604 Other Environmental Pollutant Effects

39449 **Photocontrol of the functional coupling between photosynthesis and stomatal conductance in the intact leaf.** Zeiger, E.; Field, C. (Stanford Univ., CA). *Plant Physiology;* 70: No. 2, 370-375(Aug 1982). Contract AT03-81ER10924.

The photocontrol of the functional coupling between photosynthesis and stomatal conductance in the leaf was investigated in gas exchange experiments using monochromatic light provided by lasers. Net photosynthesis and stomatal conductance were measured in attached leaves of Malva parviflora L. as a function of photon irradiance at 457.9 and 640.0 nanometers. Photosynthetic rates and quantum yields of photosynthesis were higher under red light than under blue, on an absorbed or incident basis. Stomatal conductance was higher under blue than under red light at all intensities. Based on a calculated apparent photon efficiency of conductance, blue and red light had similar effects on conductance at intensities higher than 0.02 millimoles per square meter per second, but blue light was several-fold more efficient at very low photon irradiances. Red light had no effect on conductance at photon irradiances below 0.02 millimoles per square meter per second. These observations support the hypothesis that stomatal conductance is modulated by two photosystems: a blue light-dependent one, driving stomatal opening at low light intensities and a photosynthetically active radiation (PAR)-dependent one operating at higher irradiances. When low intensity blue light was used to illuminate a leaf already irradiated with high intensity, 640 nanometers light, the leaf exhibited substantial increases in stomatal conductance. Net photosynthesis changed only slightly. Additional far-red light increased net photosynthesis without affecting stomatal conductance. These observations indicate that under conditions where the PAR-dependent system is driven by high intensity red light, the blue light-dependent system has an additive effect on stomatal conductance.

## 57 HEALTH AND SAFETY

*REFER ALSO TO CITATION(S) 39363*

39450 **(PB—83-178327) Characterization of contaminated nuclear sites, facilities and materials: radioisotope and radiopharmaceutical manufacturers and suppliers. Final report.** (Evaluation Research Corp., Oak Ridge, TN (USA)). 1983. 107p. NTIS, PC A06/MF A01.

The Environmental Protection Agency (EPA) is developing environmental protection standards for evaluating the risks and characterizing problems associated with disposal of radioactive wastes arising from decontamination and decommissioning DandD operations. Information on operations conducted at sites authorized to possess radioactive materials for the production and/or distribution of radioisotopes and radiopharmaceuticals was compiled and evaluated. This information was used to project the types, nature, and volumes of wastes which are likely to be generated during decontamination and decommissioning at representative facilities and identifying special problems that may occur. Radioisotope and radiopharmaceutical manufacturers have been grouped together because decommissioning operations will be similar. Nuclear pharmacies were also evaluated because of their increasing numbers and their role as middlemen between manufacturers and users of radiopharmaceuticals. The majority of the radioactive waste will arise from the decontamination of the laboratories, rather than the disposal of components.

39451 **(PNL-SA—11155) Overall design considerations in male and female occupational reproductive studies.** Sever, L.E.; Hessol, N.A. (Pacific Northwest Lab., Richland, WA (USA); Washington Univ., Seattle (USA). School of Public Health; Hanford Environmental Health Foundation, Richland, WA (USA)). 1983. Contract AC06-76RL01830. 53p. (CONF-830481—1). NTIS, PC A04/MF A01. Order Number DE83011830.

From RMCOEH occupational and environmental health conference; Park City, UT, USA (5 Apr 1983).

Epidemiologic studies are extremely useful for examining the possible relationships between occupational exposures and reproductive outcomes in occupational populations. In this paper, we examine some of the major epidemiologic design considerations in male and female occupational reproductive studies.

39452 **(USGS-BULL—1383-C) Potential hazards from future eruptions of Mount St. Helens volanco, Washington.** Crandell, D.R.; Mullineaux, D.R. (Geological Survey, Washington, DC (USA)). 1978. 43p. GPO.

Mount St. Helens has been more active and more explosive during the last 4500 years than any other volcano in the conterminous United States. Eruptions of that period repeatedly formed domes, large volumes of pumice, hot pyroclastic flows, and during the last 2500 years, lava flows. Some of this activity resulted in mudflows that extended tens of kilometers down the floors of valleys that head at the volcano. This report describes the nature of these phenomena and their threat to people and property; the accompaning maps show areas likely to be affected by future eruptions of Mount St. Helens. Explosive eruptions that produce large volumes of pumice affect large areas because winds can carry the lightweight material hundreds of kilometers from the volcano. Because of prevailing winds, the 180° sector east of the volcano will be affected most often and most severely by future eruptions of this kind. However, the pumice from any one eruption probably will fall in only a small part of that sector. Pyroclastic flows and mudflows also can affect areas far from the volcano, but the areas they affect are smaller because they follow valleys. Mudflows and possibly pyroclastic flows moving rapidly down Swift and Pine Creeks could displace water in Swift Reservoir, which could cause disastrous floods farther downvalley.

## 58 GEOSCIENCES

39453 **(PB—83-171827) Bureau of Mines research 82: a sumMary of significant results in mineral technology and economics. Special pub.** Pederson, J.R. (Bureau of Mines, Avondale, MD (USA). Avondale Research Center). Dec 1982. 147p. NTIS, PC A07/MF A01.

Minerals, and the adequacy of America's mineral supply, are subjects of growing national concern in the 1980's. They have been subjects of concern to the Bureau of Mines for most of this century. The Bureau's mission is to help assure an adequate and dependable flow of minerals at reasonable costs. That mission is pursued through the acquisition and analysis of minerals data on a worldwide basis, and through research to make mining and mineral processing safer, more productive, and more compatible with the effective use of all the Nation's resources. Research 82 is the 12th annual summary of significant developments in Bureau programs. It reflects both the scope of the Bureau's mission, and the success with which that mission is being pursued.

## 5801 Geology And Hydrology

*REFER ALSO TO CITATION(S) 38483, 38554, 38559, 38560, 39361, 39373, 39385*

**39454 (BCEMPR-P—1979-1) Geological fieldwork, 1978. A summary of field activities of the Geological Division, Mineral Resources Branch.** (British Columbia Ministry of Energy, Mines and Petroleum Resources, Victoria (Canada)). Jan 1979. 2p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780701.

Individual items in scope for the data base are processed separately. (DLC)

**39455 (GSCan-P—81-1B) Current research. Part B.** (Geological Survey of Canada, Ottawa, Ontario). 1981. 188p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE83780699.

Items within the scope of EDB have been entered individually into the data base. (ACR)

**39456 (GSCan-P—81-1C) Current research. Part C.** (Geological Survey of Canada, Ottawa, Ontario). 1981. 148p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83780700.

Items within the scope of EDB have been entered individually into the data base. (QCR)

**39457 (PB—83-174433) Cottage Grove Fault System in southern Illinois.** Nelson, W.J.; Krausse, H.-F.; Bristol, H.M. (Illinois Inst. of Natural Resources, Champaign (USA). State Geological Survey Div.). 1981. 73p. NTIS, PC A04/MF A01.

The Cottage Grove Fault System is one of the major tectonic fault systems in southern Illinois. It extends from the Saline-Gallatin County line westward at least as far as Campbell Hill in Jackson County, a distance of about 70 miles. The zone of faulting is as much as 10 miles wide, and individual faults have as much as 200 feet of vertical offset. The age of faulting in the Cottage Grove system is certainly post-middle Pennsylvanian and pre-Pleistocene. Although several finds of oil and gas have been made in structural traps along the Cottage Grove Fault System, production from the area south of the system has been negligible. The fault system transects a major coal mining region, and its effect on mining operations is serious and detrimental.

**39458 (RHO-BW-SA—289-P) Crustal structure of the Columbia Plateau region, Washington.** Rohay, A.C.; Malone, S.D. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Apr 1983. Contract AC06-77RL01030. 22p. (CONF-830596—1). NTIS, PC A02/MF A01. Order Number DE83013478.

From Seismological Society of America meeting; Salt Lake City, UT, USA (2 May 1983).

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Refraction data from blasts recorded in eastern Washington between 1980 and 1983 are used to determine the upper crustal structure of the Columbia Plateau. Fourteen blast sites with over 25 individual shots were recorded on the University of Washington regional seismic network made up of 36 short-period seismograph stations recorded digitally at 100 samples/s. Additional data were obtained from a 12-station dense digital network in the central plateau operated by the Rockwell Hanford Operations Basalt Waste Isolation Project. Major crustal refractors of 5.1 and 6.05 km/s are observed at distances of 15 to 50 km and 50 to 120 km, respectively. A time-term method is used to model layer thicknesses below the stations for each major refractor. A statistical source-receiver separation operation is used to handle the inherent nonindependence of the data. Constraints are used to fix the mean values of the time terms. Ray tracing through two-dimensional velocity structures is used to augment the interpretation of the time-term solutions for areas where the lateral velocity changes are large. Station delays for the 5.1-km/s layer show a good correlation with elevation and surficial geology. The areal extent of the 5.1-km/s layer roughly coincides with the Columbia River basalts. Time terms from the 6.05-km/s layer indicate a nearly uniform depth of 1 to 2 km in the northern plateau. Time terms in the central plateau indicate a depth to the 6.05-km/s layer of over 8 km, and a systematic thinning away from its center. Magnetotelluric studies indicate that the basalts are probably no thicker than 5 km in the central Columbia Plateau region.

**39459 (SAND—81-1970) Petrology and geochemistry of the Grouse Canyon Member of the Belted Range Tuff, Rock-Mechanics Drift, U12g Tunnel, Nevada Test Site.** Connolly, J.R.; Mansker, W.L.; Hicks, R.; Allen, C.C.; Husler, J.; Keil, K.; Lappin, A.R. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1983. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01. Order Number DE83013821.

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G-Tunnel at Nevada Test Site (NTS) is the site of thermal and thermomechanical experiments examining the feasibility of emplacing heat-producing nuclear wastes in silicic tuffs. This report describes the general stratigraphy, mineralogy, and bulk chemistry of welded portions of the Grouse Canyon Member of the Belted Range Tuff, the unit in which most of these experiments will be performed. The geologic characteristics of the Grouse Canyon Member are compared with those of the Topopah Spring Member of the Paintbrush Tuff, presently the preferred horizon for an actual waste repository at Yucca Mountain, near the southwest boundary of Nevada Test Site. This comparison suggests that test results obtained in welded tuff from G-Tunnel are applicable, with limitations, to evaluation of the Topopah Spring Member at Yucca Mountain.

**39460 (USGS-BULL—1444) Geology and thermal history of Mammoth Hot Springs, Yellowstone National Park, Wyoming.** Bargar, K.E. (Wyoming Geological Survey, Laramie (USA)). 1978. 70p. GPO.

Mammoth Hot Springs, located about 8 km inside the north entrance to Yellowstone National Park, consists of nearly 100 hot springs scattered over a score of steplike travertine terraces. The travertine deposits range in age from late Pleistocene to the present. Sporadic records of hot-spring activity suggest that most of the current major springs have been intermittently active since at least 1871. Water moving along the Norris-Mammoth fault zone is heated by partly molten magma and enriched in calcium and bicarbonate. Upon reaching Mammoth this thermal water (temperature about 73°C) moves up through the old terrace deposits along preexisting vertical linear planes of weakness. As the water reaches the surface, pressure is released, carbon dioxide escapes as a gas, and bicarbonate in the water is partitioned into more carbon dioxide and carbonate; the carbonate then combines with calcium to precipitate calcium carbonate, forming travertine. This report summarizes the relevant data concerning the geology of the travertine deposits and the history of hot-spring activity at Mammoth Hot Springs.

**39461 (USGS-PP—1053) Potential effects of deep-well waste disposal in western New York.** Waller, R.M.; Turk, J.T.; Dingman, R.J. (Geological Survey, Washington, DC (USA); New York State Geological Survey, Albany (USA)). 1978. 44p. GPO.

A deep waste-disposal well was drilled at Lackawanna, New York, for proposed disposal of a highly acidic, iron-rich waste solution (waste pickle liquor) from a steel mill into a dolomitic sandstone. This report evaluates the hydraulic, seismic, and geochemical aspects and the feasibility of such disposal. Hydraulic reactions under field pressure and field temperatures were simulated by mathematical models, and chemical reactions by laboratory models. The mathematical results are compared with 1968 freshwater injection-test data obtained from state records. The sandstone and fractured dolomite rocks of the disposal unit would theoretically accept the waste pickle liquor. Within a year, however, at an injection rate of 50 gallons per minute, the wellhead pressure would be about 600 pounds per square inch. Chemical reactions between acidic wastes and brine-saturated, unfractured dolomite would create precipitates that would drastically reduce the already low permeability of the unfractured part of the dolomite. Fractures in the dolomite would probably not become plugged by chemical precipitates, however. Nondolomitic sandstone permeability may not be affected. In general, the fractured dolomite and the sandstone parts of the sequence

would probably maintain their present permeability so that the effective injection rate could be sustained. Generation of carbon dioxide may be a problem in that excessive pressures could develop.

39462 **Dating terrestrial carbonate cementation with uranium-series isotopes.** Ku, T.L.; Joshi, L.U. (University of Southern California, Los Angeles (USA). Dept. of Geological Sciences). pp 551-557 of Management of environment [a felicitation volume presented to Dr A.K. Ganguly]. Patel, B. (ed.) (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). New Delhi, India; Wiley Eastern (1980).

Carbonate cementations of an arid-region fanglomerate deposit near Isfahan in Iran have been dated by measurement of $^{230}Th/^{234}U$ activit.v ratio. Analytical procedure is described and the method of age calculation and corrections for detrital contamination in age calculation are explained. The results of dating by this method agree well with those arrived on the basis of geomorphic considerations.

39463 **Geological fieldwork, 1979. A summary of field activities of the Geological Division, Mineral Resources Branch.** Victoria, British Columbia; British Columbia Ministry of Energy, Mines and Petroleum Resources (1980). vp. (BCEMPR-P—1980-1). BC Ministry of Energy, Mines, and Petroleum Resources, Parliament Buildings, Victoria, B.C., Canada V8V 1X4.

Individual items in scope for the data base are processed separately. (DLC)

## 5802 Geophysics

*REFER ALSO TO CITATION(S) 38487, 39452*

39464 **(LA-UR—83-1524) Los Alamos close-in seismic program at the Nevada Test Site.** Edwards, C.L.; Harper, M.D.; Weaver, T.A.; Cash, D.J.; Ray, J.M.; Homuth, E.F. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 31p. (CONF-8111147—2). NTIS, PC A03/MF A01. Order Number DE83012776.

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

In the fall of 1976, the Los Alamos Close-In Seismic Network was added to the existing strong motion net deployed around each nuclear test conducted by Los Alamos. Six to ten stations, including both accelerometers and seismometers, are installed within a two-DOB (depth of burial) circle around SGZ (surface ground zero) and operated until the major portion of the microquake activity ceases, usually within 48 hours. Epicentral locations are determined and local magnitudes are calculated from event durations. Four primary conclusions have been reached on the basis of the data analyzed to date: (1) major faults bounding the immediate site of a nuclear test confine the observed microquake activity to the structural block in which the test is conducted; (2) microquake epicenters are generally distributed around the cavity created by the nuclear test with the peak occurrence generally occurring about three cavity radii away from the working point; (3) magnitudes of locatable microquakes apparently distribute randomly over the entire region of activity; and (4) the microquake activity as a function of time appears to be controlled by the collapse phenomenology.

39465 **(UCID—19805) Structural analysis of the southeastern Livermore Basin, California.** Springer, J.E. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 234p. NTIS, PC A11/MF A01. Order Number DE83013700.

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The Livermore Basin is a roughly triangular 460 $km^2$ (165 $mi^2$) region in the Coast Ranges of California. The study area lies in the southeast corner of the Livermore Basin. Deposition in the area occurred from Late Jurassic to Holocene time. Upper Mesozoic and Paleocene deposits were laid down on a more regional scale and the Livermore Basin itself became a discrete depositional system during late Paleogene time. Recent uplift has left the Livermore Valley as the only active remnant of the older depositional system. The Livermore Valley is a 25 km (16 mi) by 11 km (7 mi), east-trending topographic and structural basin in the central Coast Ranges of California. Its long axis trends roughly perpendicular to the north-northwest structural grain of the region and this fact has puzzled geologists for many years. Faulting in the valley has helped to form structural traps for hydrocarbons such as in the Livermore oil field adjacent to the Lawrence Livermore National Laboratory. This paper analyzes the structure of the eastern Livermore Valley by combining field data with information gained in hydrocarbon exploration.

39466 **(UCRL—89270) Seismic experiments at Lawrence Livermore National Laboratory using RSTN data.** Taylor, S.R.; Owens, T.J.; Nakanishi, K.K.; Rodgers, P.W.; Patton, H.J. (Lawrence Livermore National Lab., CA (USA)). 16 May 1983. Contract W-7405-ENG-48. 23p. (CONF-830579—1). NTIS, PC A02/MF A01. Order Number DE83013047.

From 5. annual DARPA/AFOSR symposium; Eastsound, WA, USA (16 May 1983).

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The Department of Energy has installed a Regional Seismic Test Network (RSTN) in North America in order to gain experience with advanced seismic monitoring systems. The RSTN is the prototype for a seismic network that could be deployed in the Soviet Union under terms of a Comprehensive Test Ban Treaty (CTBT). The RSTN is intended to provide three-component, digital seismic data at both regional and teleseismic distances over a broad frequency range (0.02 to 10 Hz). Several projects were undertaken using seismic data from the RSTN system to characterize properties of the network and validate its performance. The data from the network was used to investigate local crustal structure, explain anomalous arrivals, verify the accuracy of seismograms recorded at the stations, and determine the yield of seismic events using measurements of seismic moments. Brief summaries of these projects are presented.

39467 **(UCRL—89368) Detection and characterization of a perched aquifer with an electrical-resistivity survey.** Sweeney, J.J. (Lawrence Livermore National Lab., CA (USA)). Jun 1983. Contract W-7405-ENG-48. 26p. (CONF-830561—2). NTIS, PC A03/MF A01. Order Number DE83013861.

From 3. national symposium on aquifer restoration and ground water monitoring; Columbus, OH, USA (25 May 1983).

Two different electrical methods were used and compared in the investigation of a solid-waste landfill site in the central Coast Ranges of California. The methods were used in support of an investigation of the hydrology and geochemistry of the site with main concerns being (1) establishment of baseline conditions, (2) determination of possible contamination, and (3) design of a sampling/monitoring system. Data were obtained prior to the start of the drilling program and later integrated with reconnaissance geologic data for the purpose of selecting sites for monitoring wells. Two electrical methods were used: (1) dipole-dipole resistivity; and (2) terrain conductivity. Interpretations of the surveys, discussed below, were used in characterizing the geometry of the saturated zone, estimating groundwater gradients, and estimating relative depths to the saturated zone.

39468 **(USGS-OFR—83-321) Commercial geophysical well logs from the USW G-1 drill hole, Nevada Test Site, Nevada.** Muller, D.C.; Kibler, J.E. (Geological Survey, Reston, VA (USA)). 1983. Contract AI08-78ET44802. 22p. NTIS, PC A02/MF A01. Order Number DE83012884.

Drill hole USW G-1 was drilled at Yucca Mountain, Nevada Test Site, Nevada, as part of the ongoing exploration program for the Nevada Nuclear Waste Storage Investigations. Contract geophysical well logs run at USW G-1 show only limited stratigraphic correlations, but correlate reasonably well with the welding of the ash-flow and ash-fall tuffs. Rocks in the upper part of the section have highly variable physical properties, but are more uniform and predictably lower in the section.

**39469 Kilauea Iki lava lake: geophysical constraints on its present (1980) physical state.** Hermance, J.F.; Colp, J.L. (Brown Univ., Providence, RI). *Journal of Volcanology and Geothermal Research;* 13: No. 1-2, 31-61(Jul 1982).

A model is presented representing the present-day (1980) configuration of Kilauea Iki lava lake. This interpretation is a synthesis of the results of drilling, thermal modelling, petrology and geophysical sensing experiments. According to this model, the crust of the lava lake is characterized by a thick two-phase convection-dominated zone and a single-phase (steam) dry-out zone. Geophysical measurements (namely electromagnetic sounding experiments) suggest the presence of an anomalous zone which is significantly thicker (more than 30 m thick at 40 m depth) than the zone of melt-slush (10 m thick at 54 m depth) seen in petrological investigations of the drill core. This suggests that the geophysically active zone is caused by physical processes not directly related to the presence of magma or that the magma is thinly disseminated over a broader region than indicated in petrlogical inspections of recent (1979) drill cores. We cannot at this time rule out (or support) the possibility of a plexus of segregation veins distributed throughout the high-temperature region of the lake, particularly below the melt-slush region where information is sparse.

## 5803 Mineralogy, Petrology, And Rock Mechanics

*REFER ALSO TO CITATION(S) 38462, 38464, 38553, 39336, 39460, 39461*

**39470 (BARC—1156) Current status of thermoluminescence studies on minerals and rocks.** Sankaran, A.V.; Nambi, K.S.V.; Sunta, C.M. (Bhabha Atomic Research Centre, Bombay (India)). 1982. 157p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83701645.

Microfiche only, copy does not permit paper copy reproduction81 refs., 9 tables, 53 figures.

The usefulness of thermoluminescence (TL) in geological studies is being increasingly recognized, as may be judged from the considerable volume of literature accumulated over the past couple of decades; besides, a number of seminars, conferences and specialists' meetings have also been held on the subject of applied TL. However, these publications lie scattered over several periodicals and conference proceedings and an interested worker finds it difficult to obtain the gist of the contributions in one place. The present authors felt a need for this and have, therefore, attempted to bring together in this Report the current status of TL research about different minerals; applications in the fields of geochronology, ore-prospecting, stratigraphic correlation, geothermometry and other useful areas are also included.

**39471 (ONWI—190(3)) Nitrogen gas permeability tests at Avery Island.** Blankenship, D.A.; Stickney, R.G. (RE/SPEC, Inc., Rapid City, SD (USA)). Apr 1983. Contract AC06-76RL01830. 34p. NTIS, PC A03/MF A01. Order Number DE83013111.

Several nitrogen gas permeability tests have been performed at the Avery Island field site. These included a preliminary suite of tests performed at various locations around the site, tests performed in conjunction with the brine movement studies, and a series of extended permeability measurements. As a result of the preliminary tests and the brine movement tests, further tests were justified to refine the measurement technique and resolve observed anomalies. This report presents data acquired during the extended permeability measurements at Avery Island, analysis of the data, and comparison of the data with a finite-element simulation. Permeabilities were found as low as $4 \times 10^{-20}$ ft$^2$ and as high as $6 \times 10^{-17}$ ft$^2$ with a tendency of permeability decreasing as temperatures increased.

**39472 (ONWI—237) Priori numerical predictions of various in-situ accelerated borehole-closure experiments.** Loken, M.C. (RE/SPEC, Inc., Rapid City, SD (USA)). Apr 1983. Contract AC06-76RL01830. 42p. NTIS, PC A03/MF A01. Order Number DE83013906.

A priori numerical simulations of in-situ experiments ongoing at Avery Island, LA have been performed. The specific experiments analyzed involved the accelerated borehole closure in a salt core subjected to both circumferential pressure and heating. The initial in-situ stress field in the mine floor of the experimental test area was determined to have a negligible effect on the stresses within the salt core and was assumed to be zero in performing the numerical investigation. Plasticity analyses were required to determie the post-loading stress state because plastic yielding occurs, primarily in the region below the pressurized annulus. After 100 days the maximum thermo/viscoelastic closure of the borehole occurs at approximately middepth.

**39473 (ONWI—250) Quasi-static strength and creep characteristics of 100-mm-diameter specimens of salt from Avery Island, Louisiana.** Mellegard, K.D.; Senseny, P.E.; Hansen, F.D. (RE/SPEC, Inc., Rapid City, SD (USA)). Apr 1983. Contract AC06-76RL01830. 219p. NTIS, PC A10/MF A01. Order Number DE83012965.

This report primarily describes triaxial compression creep experiments performed on dome salt from Avery Island, Louisiana. The ranges of axial stress difference $\Delta\sigma$, confining pressure $\sigma 2$, and temperature T studied covered those expected in a nuclear waste repository: $5.4 \leqq \Delta\sigma \leqq 20.7$ MPa, $0.7 \leqq \sigma 2 \leqq 20.7$ MPa, 24°C $\leqq T \leqq$ 200°C. All specimens exhibited transient creep, and the strain data were fitted to a constitutive law of the form $\epsilon = At/\sup m/\Delta\sigma/\sup n/T/\sub p/$. The duration of some creep experiments was long enough for the specimens to reach steady-state deformation. An activation energy for the rate-controlling deformation mechanism was calculated using data from these experiments. A few quasi-static strength tests were performed at 24°C. A common load rate of 0.002 MPa/sec was used for each experiment while confining pressures ranged from 0 to 20.7 MPa. The data presented in this report obtained using 100-mm-diam specimens. The results were compared to previous work, which used 50-mm-diam specimens.

**39474 (ONWI—430) UTAH2: a finite-element model for simulating thermoelastic-plastic behavior in anisotropic rock masses.** (INTERA Environmental Consultants, Inc., Houston, TX (USA)). Apr 1983. Contract AC06-76RL01830;AC02-83CH10140. 222p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE83013905.

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UTAH2 is a two-dimensional thermomechanical finite-element code designed to evaluate deformation in a rock mass exhibiting highly anisotropic strength properties. The code was developed by the University of Utah under the US Bureau of Mines. This report is written to supplement the final report for the aforementioned USBM contract and to fulfill the need for performance, design, and test specifications in accordance with the format required. UTAH2 can be used to model the mechanical and thermomechanical behavior of sedimentary rocks such as shales or bedded salt deposits. The code can take into account anisotropic elastic, plastic, and brittle behavior, time-dependent properties, temperature-dependent properties, arbitrary extraction and fill sequences, and the effects of artificial support systems on stability in layered media. The yield criteria is an extended von Mises criteria that was developed especially for analyzing bedded rock masses showing anisotropic strength properties. The code does not analyze creep behavior and does not take individual fractures into consideration. UTAH2 is mainly suitable for use in repository, room, and canister scale studies of the excavation, operational, and short-term post closure processes.

**39475 (RHO-BW-SA—262P) In-situ stress measurement in a jointed basalt: the suitability of five overcoring techniques.** Gregory, E.C.; Rundle, T.A.; McCabe, W.M.; Kim, K. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). May 1983. Contract AC06-77RL01030. 21p. (CONF-830611—2). NTIS, PC A02/MF A01. Order Number DE83013812.

From Rapid excavation and tunneling conference; Chicago, IL, USA (12 Jun 1983).

Overcoring tests were conducted at the Near-Surface Test Facility (NSTF) to assess the suitability of five techniques (US Bureau of Mines borehole deformation gauge (BDG), Commonwealth Scientific and Industrial Research Organization (CSIRO) hollow inclusion stress cell, epoxy inclusion, Lulea triaxial gauge

(LuH gauge), and Council for Scientific and Industrial Research (CSIR) doorstopper) for in situ stress determination in a closely jointed basalt. This effort is in support of the Basalt Waste Isolation project, which is studying the feasibility of locating a nuclear waste repository in the basalts of the Hanford Site in southeastern Washington. This paper preents the results from the overcoring study that formed the basis for selection of two techniques to be used during the further exploration of the basalt formations at depth.

**39476 (RHO-BW-SA—286P) Design and construction of a block test in closely jointed rock.** Black, M.T.; Cramer, M.L. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Jun 1983. Contract AC06-77RL01030. 15p. NTIS, PC A02/MF A01. Order Number DE83013740.

The Basalt Waste Isolation Project developed a large-scale block test to investigate the in-situ deformational response of a basalt rock mass. The test was designed and installed into the vertical rib (wall) of a tunnel to examine the response of basalt both in a parallel and perpendicular mode to the basalt columns. The salient challenge confronting the design and development of the test was a lack of documented experience for testing into a vertical wall. Information was available for testing in a horizontal surface. The major tasks involved in the implementation of this test included flat-jack slot drilling, instrumentation hole drilling, cable anchor hole drilling, flat-jack installation, monitoring instrumentation installation, and cable anchor installation. Drilling in the closely jointed and fractured rock mass required extreme care to prevent unraveling of the columnar structure and to minimize the disturbance of the section to be tested. The adaptation of a high-strength cable anchor system to the space limitations of the test configuration and the design and implementation of an optical deformation monitoring device capable of achieving a measurement precision of 30 $\mu$m required equal innovation. Construction of the test facility was successfully completed on schedule in $\sim$ 25 wk.

**39477 (UCRL—53407) FRAFE: a finite-element program for stress analysis in fractured rocks.** Shaffer, R.J.; Hanson, M.E. (Lawrence Livermore National Lab., CA (USA)). Jan 1983. Contract W-7405-ENG-48. 36p. NTIS, PC A03/MF A01. Order Number DE83014487.

FRAFE is a static two-dimensional elastic finite-element program for analysis of fractured rock. It employs four-node rectangular elements with which Mode I stress-intensity factors can be calculated. Finite elements near the edge of the grid can be expanded by an automatic zoning to reduce boundary effects. Equation solving is achieved using the Incomplete Cholesky Conjugate Gradient relaxation technique. Fractures can change direction only in 45-degree increments. The program has been applied to several analyses in fractured rock such as: surface deflection due to layering with a vertical crack; crack behavior near a bonded interface; effect of multiple cracks on interface penetration; perturbation of a stress field by the presence of lenses; and hydraulic fracturing in a nonuniform stress field.

**39478 Characterization of alluvial sources in the Owens Valley of eastern California using Fourier shape analysis.** Wagoner, J.L.; Younker, J.L. (Lawrence Livermore National Lab., CA). *Journal of Sedimentary Petrology;* **52**: No. 1, 209-214(Mar 1982). Contract W-7405-ENG-48.

Two-dimensional quartz grain shape was used to characterize sand grains from different source areas in the Owens Valley of eastern California. Combining a mathematical description of the grain outline and multivariate discriminant analysis, we have shown that quartz from clastic source rocks has a distinctive imprint when compared to samples from granitic, volcanic, or mixed fluvial source areas. Alternatively, quartz provided by a granitic source could equally well have been interpreted as if it were derived from any of the other sources considered. This study provides a standard of comparison for further analysis of sediment deposited in arid alluvial environments.

**39479 Underground rock engineering.** Montreal, Canada; CIM (1980). vp. (CONF-800522—).

From 13. symposium on rock mechanics; Ontario, Canada (28 May 1980).

Individual items in scope for the data base are processed separately. (DLC)

### 5804 Geochemistry

*REFER ALSO TO CITATION(S) 38483, 38484, 38540, 38562*

### 5805 Oceanography

**39480 (N—8314583) Interpretation of remotely sensed data and its applications in oceanography.** Parada, N.D.J.; Tanaka, K.; Inostroza, H.M.; Verdesio, J.J. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Apr 1982. 65p. (In Portuguese). (E—83-10074; NASA-CR—169585). NTIS, PC A04/MF A01.

The methodology of interpretation of remote sensing data and its oceanographic applications are described. The elements of image interpretation for different types of sensors are discussed. The sensors utilized are the multispectral scanner of LANDSAT, and the thermal infrared of NOAA and geostationary satellites. Visual and automatic data interpretation in studies of pollution, the Brazil current system, and upwelling along the southeastern Brazilian coast are compared.

## 64 PHYSICS RESEARCH

### 6401 Astrophysics And Cosmology

*REFER ALSO TO CITATION(S) 39612*

**39481 (CEA-CONF—6142) Effect of supernovae and H1 clouds on the properties of interstellar space.** Chieze, J.P. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Jun 1981. 15p. (In French). (CONF-8106224—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701664.

From La Baume Sainte Marie meeting; Aix-en-Provence, France (10 Jun 1981).

An interpretation of the McKee and Ostriker interstellar medium theory (1977) is presented. A detailed discussion on the structure of interstellar clouds is avoided. An outline of the theory is given: a) propagation of the remains of supernovae in an evaporative inhomogeneous space, b) collective effects of supernova explosions on the structure of interstellar space. Emphasis is given to the effects of the evaporation parameter and the characteristics of cloud spectra.

**39482 (CEA-CONF—6352) Violent interstellar medium associated with the Carina Nebula.** Laurent, Claudine; Pettini, Max; Paul, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1982. 3p. (CONF-8205163—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701665.

From 3. European IUE conference; Madrid, Spain (10 May 1982).

We present a detailed study of the physical conditions and chemical composition of the interstellar medium in line to HD 93205, an 03V star embedded in the Great Carina Nebula. We have identified up to six components in the ultraviolet absorption lines, spanning a velocity range of 375 km $s^{-1}$. The two main high-velocity components have been found to show different relative abundance patterns. The red-shifted component shows no depletion. For the blue-shifted component, the relative abundance pattern seems difficult to explain in terms of elements locked into grains; we tentatively attribute its composition to mixing with freshly synthetized material ejected by a recent supernova explosion. Among the two low-velocity components, one has been identified with the normal interstellar gas in the disk of the Galaxy. In this component we have measured column densities of interstellar CIV and SiIV, free from contamination by circumstellar material. The other low-velocity component has been identified with the approaching part of the expanding ionized nebula around the Carina OB associations. It

consists of a dense HII region in which the two conspicuous OI fine-structure lines originate.

**39483 (CEA-CONF—6360) Highly variable X-ray emitting objects in the Rho Oph dark cloud.** Montmerle, T.; Koch-Miramond, L.; Falgarone, E.; Grindlay, J.E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jun 1982. 4p. (CONF-820582—6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701666.

From 24. COSPAR meeting (Committee on Space Research); Ottawa, Canada (17 May 1982).

The Rho Ophiuchi dark cloud region has been the subject of an extensive guest investigation using the Einstein Observatory. The set of observations comprise 14 IPC fields and 3 HRI fields. Forty seven sources were detected at a level>3.5$\sigma$ and twenty more above 2s. The majority of these sources have optical, IR, or even radio continuum counterparts; nine are identified with known T Tauri stars, while several others are identified with stars showing H $\alpha$ in emission. All show a high degree of time variability; flux variations reach factors of 5 in a few hours, or 25 in a day. Apparent luminosities are in the range 10(30)-10(31) erg.s$^{-1}$. The possibility that the X-ray variability is due to flares is examined. If this interpretation is correct, one source has been the seat of the largest stellar flare ever recorder in X rays [Lsub(x)=10(32) erg.s$^{-1}$, Esub(x)> =10(36) ergs].

**39484 (CEA-CONF—6437) Cosmic ray acceleration mechanisms.** Cesarsky, C.J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1982. 8p. (CONF-8206171—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701942.

From 3. international school of cosmic ray astrophysics; Erice, Italy (20 Jun 1982).

We present a brief summary of some of the most popular theories of cosmic ray acceleration: Fermi acceleration, its application to acceleration by shocks in a scattering medium, and impulsive acceleration by relativistic shocks.

**39485 (CEA-CONF—6481) Galactic propagation of cosmic rays.** Cesarsky, C.J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1982. 17p. (CONF-8206171—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701943.

From 3. international school of cosmic ray astrophysics; Erice, Italy (20 Jun 1982).

After introducing various phenomenological models of cosmic ray propagation in the galaxy, we examine how some of them fare when compared to the data. We show that a model based on resonant diffusion of cosmic rays off an interstellar spectrum of hydromagnetic waves can account for the presently available evidence on cosmic rays and the interstellar medium.

**39486 (IC—81/119) Pairing in the cosmic neutrino background.** Alonso, V.; Chela-Flores, J.; Paredes, R. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1981. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701944.

We extend the discussion of the possible superfluidity of the cosmic background of neutrinos beyond the arguments based on the gap equation, originally given by Ginzburg and Zharkov. We show how to develop a simple Ginzburg-Landau liquid model, in analogy with superconductivity. We use it to show how an analysis of the energy spectrum of the universe can be formulated to include general relativistic effects on the superfluid neutrinos. Finally, in view of the Hawking and Collins careful discussion on the rotation and distortion of a spatially homogeneous and isotropic universe, we discuss the vortex dynamics that might be generated on the superfluid by rotations (allowed by the almos isotropy of the microwave background of photons) of up to 2 x $10^{-14}$ second of arc/century, but conclude that rotations of this order of magnitude would be sufficiently strong to deter the existence of the superfluid state.

**39487 (ITEF—34(1982)) Cosmological models with a quantum scalar field.** Veselov, A.I.; Lapchinskij, V.G.; Nekrasov, V.I.; Shikin, G.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 40p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701946.

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Self-consistent solutions for the evolution of isotropic cosmological models filled with quantum massive scalar field with conformal relation with gravitation are investigated. As initial state vacuum field state is accepted, vacuum being determined as field state with the least energy. Two possible types of Einstein equation modifications for account of a local independent on mass contribution into conformal anomaly vacuum polarization are investigated. It is shown that gravitational field equations with higher derivatives lead to singularities. Minimal modification of Einstein equations admits non singular cosmological models, however the production processes of vacuum quasiparticles are of many orders less than those required for the model operation under realistic Friedman regime.

**39488 (ITEF—155(1981)) Method and program for the numerical calculation of discrete stellar models with pressure depending on the density and spatial coordinate.** Nadezhin, D.K.; Razinkova, T.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 47p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701945.

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A method for computation of discrete hydrostatic equilibrium stellar models is described for the case when the dependence of pressure on density and spatial coordinate is specified. The appropriate finite-difference equations are solved by fitting at an arbitrary intermediate interface of two successive inversely directed integrations, with one starting from stellar centre and the other from stellar surface. The effectiveness of the method is demonstrated by calculating the finite-difference polytropic stellar models. A brief description of the program realizing the algorithm proposed and proper operational instructions are presented as well.

**39489 (JINR—E-2-82-506) Solitons in N-4 extended supergravity.** Makhankov, V.G.; Rashaev, O.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701867.

From 21. International conference on high energy physics; Paris (France) (1982).

SU(4) extended supergravity is considered. The classical equations of motion for scalar PHI and pseudoscalar B fields are shown to be equivalent to the O(2.1) nonlinear four-dimensional $\sigma$-model. The axially symmetric stationary equations of motion are reduced to the Ernst equations as well as that for pure gravitation. The Ernst equations are integrable via the inverse problem technique. Soliton solutions for total supergravity may be obtained by means of superrotation.

**39490 (KFKI—1982-68) Charge exchange in solar wind - coometary interactions.** Gombosi, T.I.; Horanyi, M.; Kecskemety, K.; Cravens, T.E.; Nagy, A.F. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Aug 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701667.

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The authors examine the effect of charge exchange between fast solar wind ions and slow cometary neutrals at the contact discontinuity separating the ionosphere of a comet from the solar wind flow. The continuity equations were solved analytically for a water-dominated cometary ionosphere, including both ionization and recombination processes. It was found that this new solution differs significantly from the one obtained by neglecting recombination.

39491 (N—8320846, pp 3-14) **Chromospheric structure in relation to radiation losses.** Athay, R.G. 1981. NTIS, PC A12/MF A01.

In Second Cambridge workshop on cool stars, stellar systems, and the sun. Vol. 1.

It is assumed that cool star chromospheres are heated by mechanical energy dissipation that depends quasilinearly on density and cooled by radiation loss and it is shown that the basic properties of chromospheres are determined by the ionization of hydrogen. It is hydrogen ionization that provides the freedom for chromospheres to adjust their radiation losses to balance the prescribed heat input, resulting in an extended region of low temperature gradient. Chromospheric radiation losses in cool stars occur mainly in the strongest spectral lines at wavelengths greater than about 2000 A and the fraction of the chromosphere is effectively thin. The most important lines include Ca II H and K and the infrared triplet and Mg II h and k. The strong lines of other abundant species, are less important because their high excitation energies reduce the collisional excitation rates. Lyman alpha losses are important because of the overwhelming abundance of hydrogen. However, the inability of chromospheres to adjust their Lyman alpha losses limits the geometrical thickness of the effectively thin region in Lyman alpha and limits the total Lyman alpha flux.

39492 (N—8320846, pp 201-205) **Stellar contributions to the diffuse soft X-ray background.** Bookbinder, J.; Avni, Y.; Golub, L. 1981. NTIS, PC A12/MF A01.

In Second Cambridge workshop on cool stars, stellar systems, and the sun. Vol. 1.

One of the results of the EINSTEIN/c.f.A. X-ray stellar survey was a determination of the contribution of the disk stellar population to the galactic component of the diffuse soft (0.28 - 1.0 keV) X-ray background. This analysis employed both binned and unbinned nonparametric statistical methods that have been developed by Avni, et al. (1980). These methods permitted the use of the information contained in both the 22 detections and 4 upper bounds on the luminosities of 26 dM stars in order to derive their luminosity function. Luminosity functions for earlier stellar types are not yet developed. For these earlier stellar types, the median luminosities as determined by Vaiana, et al., are used (1981), which underestimates their contribution to the background. We find that it is the M dwarfs that dominate the disk population stellar contribution to this background. To calculate the contribution of the stellar sources to the background, simple models both for the spatial distribution of the stars and for the properties of the intervening interstellar medium are used. A model is chosen in which all stellar classes have the same functional form for their spatial distribution: an exponentially decreasing distribution above the galactic equatorial plane, and a uniform distribution within the galactic plane for a region of several kiloparsecs centered on the Sun.

39493 (N—8320892) **The soft X-ray diffuse background.** Mccammon, D.; Burrows, D.N.; Sanders, W.T.; Kraushaar, W.L. (Wisconsin Univ., Madison (USA)). 1982. 76p. (NASA-CR—170062). NTIS, PC A05/MF A01.

Maps of the diffuse X-ray background intensity covering essentially the entire sky with approx. 7 deg spatial resolution are presented for seven energy bands. The data were obtained on a series of ten sounding rocket flights conducted over a seven-year period. The different nature of the spatial distributions in different bands implies at least three distinct origins for the diffuse X-rays, none of which is well-understood. At energies or approx. 2000 eV, an isotropic and presumably extraglalactic 500 and 1000 eV, an origin which is at least partially galactic seems called for. At energies 284 eV, the observed intensity is anticorrelated with neutral hydrogen column density, but we find it unlikely that this anticorrelation is simply due to absorption of an extragalactic or halo source.

39494 (UCRL—52000-83-3) **Energy and Technology Review.** (Lawrence Livermore National Lab., CA (USA)). Mar 1983. Contract W-7405-ENG-48. 67p. NTIS, PC A04/MF A01. Order Number DE83012528.

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This journal contains 7 articles pertaining to astrophysics. The first article is an overview of the other 6 articles and also a tribute to Jim Wilson and his work in the fields of general relativity and numerical astrophysics. The six articles are on the following subjects: (1) computer simulations of black hole accretion; (2) calculations on the collapse of the iron core of a massive star; (3) stellar-collapse models which reveal a possible site for nucleosynthesis of elements heavier than iron; (4) modeling sources for gravitational radiation; (5) the development of a computer program for finite-difference mesh calculations and its applications to astrophysics; (6) the existence of neutrinos with nonzero rest mass are used to explain the universe. Abstracts of each of the articles were prepared separately. (SC)

39495 (UCRL—52000-83-3, pp 1-3) **Pioneer of numerical astrophysics.** Mar 1983. NTIS, PC A04/MF A01.

In Energy and Technology Review.

A tribute to LLNL's scientist, Jim Wilson is given. A brief discussion follows on his contributions to the fields of general relativity and astrophysics. Also, given are brief discussions of the following articles in the journal which were presented at an astrophysics meeting held to honor Jim Wilson. (SC)

39496 (UCRL—52000-83-3, pp 4-11) **Black hole accretion: the quasar powerhouse.** Mar 1983. NTIS, PC A04/MF A01.

In Energy and Technology Review.

A program is described which calculates the effects of material falling into the curved space-time surrounding a rotation black hole. The authors have developed a two-dimensional, general-relativistic hydrodynamics code to simulate fluid flow in the gravitational field of a rotating black hole. Such calculations represent models that have been proposed for the energy sources of both quasars and jets from radiogalaxies. In each case, the black hole that powers the quasar or jet would have a mass of about 100 million times the mass of the sun. The black hole would be located in the center of a galaxy whose total mass is 1000 time greater than the black hole mass. (SC)

39497 (UCRL—52000-83-3, pp 12-19) **Does stellar collapse produce supernovae or black holes.** Mar 1983. NTIS, PC A04/MF A01.

In Energy and Technology Review.

This article describes the most recent calculations on the model of supernova explosions. The author postulates that a supernova is produced by gravitational collapse of a star after it has burned all of its thermonuclear material. The end product of the burn is iron; thus, just before the star collapses, it has a central core composed of iron. During the collapse, the energy, released by the gravitational field is used to decompose the iron into lighter nuclei. Finally, the core consists of hot neutrinos, electrons, protons, neutrons, and helium nuclei. The pressure at the center of the star becomes sufficiently high to stop the collapse suddenly and to produce outwardly directed shock waves. It is thought that this shock wave may be strong enough to eject the outer material of the star. The new calculations produce explosions whose energy is slightly too low to explain most observed supernova. (SC)

39498 (UCRL—52000-83-3, pp 20-27) **Magnetorotational collapse of an iron stellar core.** Mar 1983. NTIS, PC A04/MF A01.

In Energy and Technology Review.

A discription is given of an investigation of the collapse of a star with a very high rotational rate and a very strong magnetic field. The objective of the calculations is to see whether neutron-rich matter could be ejected in an amount sufficient to account for the production of neutron-rich isotopes much heavier than iron, called r-process elements. Several stellar collapse models were studied. One called ROTB being the most likely candidate for r-process nucleosynthesis. (SC)

39499 (UCRL—52000-83-3, pp 28-37) **Modeling sources of gravitational radiation.** Mar 1983. NTIS, PC A04/MF A01.

In Energy and Technology Review.

A computer code has been developed to aid in the mathematical simulation of violent stellar collisions and collapses expected to generate gravity waves. Numerical methods were used in the

code to allow for the calculation of accurate solutions to nonspherical general-relativistic hydrodynamic problems when relativistic effects are strong. This code is a tool that can be used to solve dynamic relativistic problems. In one class of such problems no matter is present. Two examples are the formation of a black hole by gravitational radiation and the interaction of gravitational waves with a black hole. In the class of problems that contain matter, the focus is on cases in which the distribution of matter is nonspherical. Examples are gravitational collapse, oscillation, and formation of black holes. Here the concern is to calculate the production of gravitational radiation from such objects. (SC)

39500 (UCRL—52000-83-3, pp 38-47) **Arbitrary: mesh computer program with applications to astrophysics.** Mar 1983. NTIS, PC A04/MF A01.

In Energy and Technology Review.

A description is given of the considerations in developing a large finite-difference computer program, the manner in which the program treats discontinuous velocities and how it moves mass, energy, and momentum from zone to zone as the mesh remaps, and finally how these features have proved useful in modeling some astrophysics problems. Examples of astrophysics problems this tool was used for are core collapse of a star during its transition to a supernova and modeling the radiation produced by the collision of a neutron star and an asteroid. Both calculations employed mixed-zone advection. (SC)

39501 (UCRL—52000-83-3, pp 48-61) **Collisionless matter and galaxy formation.** Mar 1983. NTIS, PC A04/MF A01.

In Energy and Technology Review.

A recently proposed model for the formation of galaxies is described. The isotropy of the 3 K radiation implies that the material that coupled to the radiation field was in an extremely homogeneous spatial distribution at the time of decoupling. The problem facing scientists trying to understand matter evolves into the discrete structure of galaxies that exist today. The model is discussed and numerical results are presented of calculations that examine the evolution of perturbations on a cosmic scale and the subsequent coalescence of matter to form an individual galaxy. (SC)

39502 **Comments on the gamma-ray burst catalog of mazets.** Laros, J.G.; Evans, W.D.; Fenimore, E.E.; Klebesadel, R.W. (Los Alamos National Lab., NM). *Astrophysics and Space Science;* **88**: 243-246(1982).

A correlation has been discovered between the Venera spacecraft locations and the gamma-ray burst positions reported in the KONUS catalog. The reason for the correlation is not clear, but it could be due to spatial selection effects and/or large localization errors for weak or soft bursts. Whatever the cause, it seems likely that this systematic bias might significantly affect catalog results pertaining to gamma burst locations, intensity distributions, and spectra. For example, it can explain why the KONUS galactic latitude distribution is peaked significantly south of the galactic equator. Apparent discrepancies between the KONUS and Los Alamos gamma burst data bases are noted.

## 6402 Atmospheric Physics

39503 **Active experiments - Hypothesis testing in the magnetosphere.** Pongratz, M.B. (Los Alamos National Lab., NM). *AIAA Paper;* 6(11 Jan 1982). (CONF-820106—). Contract W-7405-ENG-36.

From 20. aerospace science conference; Orlando, FL, USA (11 Jan 1982).

Results of active observation, simulation and active perturbation experiments designed to study the upper atmosphere are presented. The Periquito Dos experiment utilized barium ions as a tracer of the throat convection pattern in the low-altitude dayside magnetospheric cusp region, while the CAMEO (Chemically Active Material Ejected from Orbit) experiment, involving thermite barium releases from 965-km altitude over the polar cap, revealed structure on auroral zone field lines extending to several earth radii. The Avefria experiments employed high-explosive shaped-charge barium injection payloads injected perpendicular to the geomagnetic field to reveal the presence of prompt striations and a slower gradient drift instability, associated with magnetospheric disturbances. Active perturbation techniques represented by the detonation of a rocket-borne ammonium nitrate/nitromethane explosive at 300 km in the topside auroral ionosphere in the Waterhole I experiment have also been used to cause a rapid depletion of the thermal plasma.

39504 **Feedback-diffraction theory of ionospheric heating.** Bernhardt, P.A.; Duncan, L.M. (Los Alamos National Lab., NM). *Journal of Atmospheric and Terrestrial Physics;* **44**: No. 12, 1061-1074(1982).

Plasma fluid equations describing concentration, velocity and temperature are coupled to the nonlinear wave equation in a numerical model of F-region heating by high power radio waves. Self-focusing of radio waves is calculated for plane waves and beams propagating in an underdense ionosphere. Ponderomotive forces are found to be negligible in comparison with thermal forces for self-focusing in the ionosphere. The structure of plasma irregularities near focal points is determined by diffraction of the radio waves.

## 6403 Atomic, Molecular, And Chemical Physics

*REFER ALSO TO CITATION(S) 39545*

39505 **(AD-A—124721/2) Variational calculation of electron elastic scattering by atomic helium. Master's thesis.** Chernek, P.J. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Dec 1982. 52p. NTIS, PC A04/MF A01.

The elastic-scattering of electrons from atomic helium in the ground state is investigated. It is shown that for low energy incident electrons the scattering problem reduced to solving an ordinary integro-differential equation for the scattering wave-function. A method is discussed to obtain approximate solutions to the integro-differential equation by variational principles. The extremum condition of the variational method is formulated into a general N x N matrix equation which reduces to a 2 x 2 eigen-value matrix problem for the phase-shift of the scattering electron. An algorithm is presented to obtain the collisional cross-section for elastic scattering as a function of incident electron energy.

39506 **(CENBG—8108) Study of K, L vacancies production mechanisms by x-ray spectrometry in the interaction induced by a few MeV/A charged particles.** Andriamonje, S. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France)). 1982. 206p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83701642.

The analysis of different mechanisms producing electronic inner shell vacancies in ion atom collisions at a few MeV/A charged is presented. The mutual influence of nuclear and atomic excitation in the ionization probability has been discussed. The $^{106}Cd(p,p')^{106}Cd$ reaction (Ep=10 MeV) has been particularly investigated from this point. The investigation is followed up by the description of the theoretical and experimental methods which permit the determination of the total and/or differential X rays production cross section for different interaction. The gold sub-shell $L_1$, $L_2$, $L_3$ ionization probability has been studied in the $Au(H^+,H^+)Au$ reaction at Ep=1 MeV. In the second part of the manuscript we investigate in detail the influence of the charge exchange process on inner shell vacancy production. The $N_2$, Ar, Kr targets have been produced by a system jet gas and bombarded by $0.8<=Ep<=3.5$ MeV proton and $^{28}Si^{10+}$ ions at E=125 MeV. The cross section for the capture of an electron in K shell, L shell and total charge exchange have been measured and compared to the CDW theory (Continuum Distorted Wave). In the CDW validity domain the experimental and theoretical results are a good agreement. In the collisions induced by $H^+$, ionization is found to be the main excitation process. On the contrary, in collisions induced by $^{28}Si^{14+}$ charge exchange is dominant compared to ionization.

**39507 (CONF-830301—17) Comparison of convoy electron production in ion-atom and ion-solid collisions.** Sellin, I.A.; Breinig, M.; Elston, S.B.; Berry, S.D. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE83009782.

From ASME-JSME thermal engineering joint conference; Honolulu, HI, USA (20 Mar 1983).

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We begin with an overview for the benefit of participants lacking acquaintance with the subject of convoy-electron production, and continue with highlights of developments occurring since a review and a comprehensive article published in 1982. A sharp cusp in the velocity spectrum of electrons, ejected in ion-atom and ion-solid collisions, is observed when the ejected electron velocity vector v/sub e/ matches that of the emergent ion vector v in both speed and direction. In ion-atom collisions, the electrons primarily originate from capture to low-lying projectile-centered continuum states (ECC) for fast bare or nearly bare projectiles, and primarily from loss to low-lying continuum states (ELC) when loosely bound projectile electrons are available. Most investigators now agree that ECC cusps are strongly skewed toward lower velocities and exhibit full widths half maxima roughly proportional to v (neglecting sometimes strong shell effects). Convoy cusps produced in heavy ion-solid collisions at MeV/u energies are slightly skewed toward high electron velocities, but exhibit velocity-independent widths, very similar to ELC cusp widths. While the shape of the convoy peaks is approximately independent of projectile Z, velocity, and target, dependence on projectile Z as $Z^{2.7}$ and energy as $E^{-3.2}$. Attempts have been made to link convoy electron production to binary ECC or ELC processes, sometimes at the last layer, or alternatively to a solid-state wake-riding model, but our measured dependences of cusp shape and yield on heavy projectile charge state q and energy are inconsistent with available theories. These wake-riding theories seek to explain the origin of convoy electrons in terms of electrons trapped into an oscillatory electron density polarization potential trailing each projectile, which are then liberated at the surface.

**39508 (DOE/ER/06035—5) Supersonic metal-cluster beams. Technical progress report.** Smalley, R.E. (Rice Univ., Houston, TX (USA). Dept. of Chemistry). 1983. Contract AS05-78ER06035. 26p. NTIS, PC A03/MF A01. Order Number DE83013349.

Recent developments in laser and molecular beam technology have now made it possible to produce supersonic beams of virtually any element in the periodic table. Using laser vaporization of the appropriate target, the beam source conditions may be adjusted to produce either the cold free atoms alone, or clusters of these atoms with each other or with another element. Initial studies of these clusters have entailed the one- and two-photon laser ionization with time-of-flight mass selective detection. Using a variety of fixed frequency laser, the work function of copper clusters has been examined as a function of cluster size in the range from 2 to 29 atoms per cluster. Considerable detailed information has also been obtained for the electronic structure and bond lengths of a number of transition metal dimers and trimers (including $Cu_2$, $Cr_2$, $V_2$, $Mo_2$, and $Cu_3$) through the use of high resolution laser spectroscopy with mass-selective photoionization detection. 41 references, 5 figures.

**39509 (DOE/ER/40048—53-L3) Search for parity nonconservation in the hydrogen atom.** Iqbal, M.Z. (Washington Univ., Seattle (USA). Dept. of Physics). 16 Mar 1983. Contract AC06-81ER40048. 223p. NTIS, PC A10/MF A01. Order Number DE83012903.

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A search for parity non-conservation was made in the hydrogen atom by looking for a small admixture of the 2P/sub 1/2/ state in the 2S/sub 1/2/ state. Since the predicted effect due to neutral current interaction is exceedingly small an interference technique was used. The two 2S/sub 1/2/(m;sub J/ = 1/2) → 2S/sub 1/2/(m/sub J/ = -1/2) parity conserving and parity non-conserving amplitudes were driven in two separate microwave cavities. A cylindrical geometry is chosen for the apparatus for a great reduction of the contributions from spurious amplitudes. The difference in the transition rate, when the relative sign of the two amplitudes are changed, is the PNC signal. The apparatus, control system and the different measurement techniques are discussed. The present results are limited by the systematic errors due to the presence of stray electric fields. The observed asymmetry when expressed in terms of $C_2$/sub p/ was found to be equal to 430 +- 500. Possible modifications for further improvement and the feasibility of an experiment in zero magnetic field is discussed in the context of future use of a thermal beam.

**39510 (IAE—3295/9) Theory of positive muon depolarization in muonium in fluctuating magnetic fields.** Ivanter, I.G.; Fomichev, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1980. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701904.

Equations describing muon depolarization in the paramagnetic muonium at the presence of fast-variable fluctuating magnetic field are obtained and investigated. Different cases occurring during the imposition of the external magnetic field-longitudinal and transverse are considered. Study of the relaxation rate of the muon spin can give sufficient information on dynamical processes in the magnetic systems, on muon diffusion and in other cases when the fast-fluctuating magnetic field appears on the muon.

**39511 (IAE—3494/6) Two electron exchange in atom-multicharged ion collisions.** Karbovanets, M.I.; Lazur, V.Yu.; Chibisov, M.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701895.

Analytical approach to investigation of nonsymmetrical two-electron exchange processes is presented. For the processes studied. in pseudointersection of terms of initial and final states, term splitting is shown to be calculated asymptotically. The asymptotics of the incident ion wave function is determined with account for the variation of the electron potential energy in a subbarrier region. The two-electron charge exchange reaction $He+C^{4+} \rightarrow He^{2+}+C^{2+}$ ($1s^22s^2$ or $1s^22s2p$) is studied in particular. The Landau-Zener model is used. The calculation results obtained are in accordance with the other calculations and experimental data for asymptotically large interatomic distances.

**39512 (ITEF—123(1981)) Nonempirical calculation of a hydrated positron.** Bugaenko, V.L.; Grishkin, V.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701896.

The possibility of a hydrated positron formation is estimated theoretically. The model of a positron surrounded by 4 water molecules is considered. The Hartree-Fock method (MO LCAO CCF) was used to calculate the binding energy of the positron in the cluster. The calculation results are compared to the corresponding data published for a hydrated electron. It is shown that the hydrated positron may exist and its hydration energy is only 0.2-0.3 eV less than that of an electron.

**39513 (JINR-R—2-82-249) Spheroidal analysis of hydrogen atom.** Mardoyan, L.G.; Pogosyan, G.S.; Sisalyan, A.N.; Ter-Antonyan, V.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701898.

The hydrogen atom in spheroidal coordinate is analysed. The limits R → 0 and R → infinity (R-the dimensional parameter characterising the spheroidal coordinates) in the three-body recurrence relations and spheroidal wave functions are considered in detail. Expansions of the normalized spheroidal wave-functions of a hydrogen atom over spherical and parabolical bases are obtained and the extremal transitions in these expansions are investigated.

**39514 (JINR-R—4-82-229) Radiation of light by the oscillator during its motion in the refractive plate.** Baryshevskij, V.G.; Frank, I.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701912.

The paper considers the radiation of light in the optical wavelength range during the motion of the fast electron through the crystal plate of limited thickness. The formulas are given for the spectral distribution and radiation intensity at the given frequency and amplitude of oscillations of the electron which correspond to the normal and anomalous Doppler effect. The calculation is performed for the light observed in the vacuum with account for reflection and refraction on the boundaries of the plate.

**39515 (JINR-R—4-82-410) Vacuum polarization effects in ddμ and dtμ mesic molecules.** Melezhik, V.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701899.

Vacuum polarization corrections ΔEsub(Jv)sup(V. p.) to the energy levels Esub(Jv) of weakly boUnd states (J=v=1) of ddμ and dtμ mesic molecules have been calculated: ΔEsub(11)sup(V. p.)(ddμ)=10 meV and Δsub(11)sup(V. p.)(dtμ)=6.5 MeV. The calculations have been performed in the adiabatic representation of the three-body problem with the account of 8 main states of the two-centre quantum mechanics problem.

**39516 (JINR-R—4-82-418) Calculations of ion-ion interaction potentials in the local-scale transformation method.** Stoitsov, M.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701900.

The possibility for application of the local-scale transformation method in the Hartree-Fock approximation for the determination of the ion-ion interaction potentials is considered. For realistic calculations it is convenient to use the obtained one-particle basis, which reproduces the results of the stationary Hartree-Fock problem with satisfactory accuracy and has simple analytic form. The ion-ion potentials are calculated with the Skyrme forces when neglecting the antisymmetrization effects and also partially taking them into account for all pairs of interacting spherical nuclei: $^{4}$He, $^{16}$O, $^{40}$Ca, $^{90}$Zr, $^{208}$Pb. The changes in the ion-ion potentials, caused by the use of the oscillator base functions instead of the Hartree-Fock wave functions, are considered.

**39517 (JINR-R—15-82-320) Experimental determination of partial probabilities for atomic capture of muons through their lifetime in mesonic atoms.** Evseev, V.S.; Mamedov, T.N.; Roganov, V.S.; Kholodov, N.I.; Frontas'eva, M.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701897.

The paper considers a method of determination of partial probabilities for atomic capture of muons through the time distribution of electrons from $\mu^- \rightarrow e^-$ - decay of a bound muon in multicomponent targets. The paper includes the results of calibration measurements for determination of values of the solid angle of the electronic telescope for different targets under the "bad" geometry conditions. The analysis of errors due to the introduction of various corrections is done.

**39518 (KIYI—81-2) Lithium atomic beam for polarized source.** Aushev, V.E.; Drozd, I.P.; Zaika, N.I.; Kibkalo, Yu.V.; Mokhnach, A.V.; Tokarev, V.P. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1981. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701901.

The first step of the classical source creation for polarized lithium ions is done. The calculations of lithium atoms trajectories in the magnetic fields are also carried out. The design of atomic lithium beam source is worked out. The dependence of beam intensity and angular width upon the temperature of atomic source is measured. Some factors of influence on the efficiency of surface ionization of lithium atoms is investigated. The dependence of intensity and angular width of beam on the temperature of atomic is measured.

**39519 (MLM—3070) Calculation of the effects of nonspherical molecules on the properties of hydrogen isotopes. I. Para-ortho collisions.** Cavagnero, M.J.; Luke, J.H.; McConville, G.T. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 3 Jun 1983. Contract AC04-76DP00053. 48p. NTIS, PC A03/MF A01. Order Number DE83013617.

The formalism is set up for obtaining phase shifts and cross sections from the numerical solution of coupled Schroedinger equations using an angle dependent potential function in combination with a physically realistic radial potential function. The resulting computer code is then used to calculate the spherical J = 0, J = O case for comparison to previous results and to calculate the J = 0, J = 1 ortho-para case. The results are compared with the spherical potential of McConville and the ortho-para calculations of Niblett and Takayanagi.

**39520 (NIIEFA-P-K—0521) Semiclassical representation for the cross sections of vibrational excitation of $N_2$ and CO by slow electrons.** Elets, I.S.; Kazanskij, A.K. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701902.

In the framework of the previously considered quasiclassical approximation for inelastic scattering through the formation of unstable molecular ion state the cross sections of vibrational excitation of $N_2$ and CO molecules from the ground as well as above lying states are calculated. In formulas which permit to make an account for arbitrary dependence of terms and width on internuclear distance model representations through the Morse function (for potential curves) and symmetry barrier factor (for the term width) are used. The agreement with the existing in literature numerical calculations and experimental data may be regarded as quite satisfactory.

**39521 (UCRL—88533) Mechanism of the optogalvanic effect in a hollow-cathode discharge.** Keller, R.A.; Warner, B.E.; Zalewski, E.F.; Dyer, P.; Engleman, R. Jr.; Palmer, B.A. (Los Alamos National Lab., NM (USA); Lawrence Livermore National Lab., CA (USA); National Bureau of Standards, Washington, DC (USA)). 17 Jun 1983. Contract W-7405-ENG-48. 12p. (CONF-830646—1). NTIS, PC A02/MF A01. Order Number DE83013583.

From Optogalvanic spectroscopy and application meeting; Aussois, France (20 Jun 1983).

There are two significantly different mechanisms proposed for the origin of the optogalvanic effect in a hollow-cathode discharge: (1) laser excitation of atoms to higher electronic states leads to an increased cross section for electron impact ionization, with the result that the excited atom becomes ionized and the conductivity of the discharge increases; and (2) laser excitation of atoms to higher electronic states perturbs the equilibrium established between the electron temperature and the atomic excitation temperature. Superelastic collisions between the electrons and the laser-excited atoms restore the equilibrium, with the excess energy ending up in an increased electron temperature and therefore an increased conductivity of the discharge. Both mechanisms undoubtedly proceed simultaneously and what needs to be determined is their relative importance at different discharge conditions and different excitation conditions. This is important because laser isotope enrichment schemes have been proposed using selective excitation in a hollow-cathode discharge. In order for these schemes to work, (1) must be the predominant mechanism. We have measured the optogalvanic signal, concentration of uranium atoms, impedance of the discharge, and electron temperature as a function of the discharge current in a neon-filled uranium hollow-cathode discharge. The hollow cathode operating characteristics are used as input parameters in a simple discharge model. Predictions of electron density, changes in electron temperature, and discharge impedance compare well with experimental observations. Our model and experimental observations yield a qualitative understanding of the optogalvanic effect in a hollow-cathode discharge and estimate the relative importance of the two optogalvanic mechanisms.

**39522 High-energy ion-atom collisions. Proceedings of the international seminar at Debrecen, Hungary, 17-19 mar 1981.** Berenyi, D.; Hock, G. (eds.). Budapest, Hungary; Akademiai Kiado (1982). vp. (CONF-810392—).

From Seminar on high energy ion-atom collision processes; Debrecen, Hungary (17 Mar 1981).

Abstracts of individual itmes from the seminar were prepared separately for the data base. (GHT)

## 6404 Fluid Physics

*REFER ALSO TO CITATION(S) 39013, 39267*

**39523 (CEA-CONF—6349) Results on heat transfer to He II for use in superconducting magnet technology.** Seyfert, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). May 1982. 8p. (CONF-820546—13). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701668.

From 9. international cryogenic engineering conference; Kobe, Japan (10 May 1982).

The paper reviews several aspects of heat transfer to He II which are of practical interest for the cooling problem of superconductors. The heat transfer characteristics in the Kapitza boundary conductance regime are discussed and typical values for technical copper are given. It is shown how the peak heat flux depends on the boundary conditions of the bulk fluid and particularly on the time behaviour of heat sources. Results on transient recovery from film boiling applicable to superconductors are also presented.

**39524 (FEI—1297) Temperature dependence of the relative density of Bose-condensate and roton density in He-2.** Puchkov, A.V.; Blagoveshchenskij, N.M.; Parfenov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701947.

7 refs.; 2 figs.; 1 tab.

Approximation of experimental values of the temperature dependence of Bose-condensate (BC)$n_0$(T) relative density by an exponential curve analogous to temperature dependence of roton density in He-2 approximately b/$\sqrt{}$ T exp($\Delta$/T) is presented. It is shown that such dependence describes experimental data by $n_0$(T) better than the power dependence approximately $n_0$(O)[1-T(T$_o$)sup(m)] which has been used for describing experimental values of the superfluid component density in the 0.8K-Tsub(A) temperature range. It is shown that in the 1.2-2.17K temperature range the temperature dependences of the BC density and roton density are described by one exponential dependence. This fact, taking into account that the normal component density is proportional to roton density, is one more proof of the interrelation of the Bose-condensation and superfluidity phenomena in liquid helium.

**39525 (FEI—1298) Study on correlations between superfluidity and Bose condensation phenomena in helium-4.** Blagoveshchenskij, N.M.; Parfenov, V.A.; Puchkov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701948.

Portions are illegible in microfiche products5 refs.

Comparison of experiments on the study of the Bose-condensate density in helium 2 by the neutron scattering method is presented. The case is considered when the initial energy of incident neutrons falling on the He2 sample is much higher than the mean energy of $^4$He thermal atom motion (Esub(i) > > T) as Well as the Esub(i) approximately T case. The evaluation of the $^4$He atom free motion relaxation in He2 in the Esub(i) approximately T case is carried out from which it follows that the Bose-condensate density constitutes $n_0$(1.2 K)=8.8+-1.3 $10^{20}$ cm$^{-3}$ and $n_0$(1.9 K)=6.3+-1.3 $10^{20}$ cm$^{-3}$.

**39526 (GEPP-TIS—532a) Constraints imposed upon theories of the vacuum arc cathode region by specific ion energy measurements.** Miller, H.C. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 17 Apr 1981. Contract AC04-76DP00656. 28p. NTIS, PC A03/MF A01. Order Number DE83013646.

The presence of high energy ions (with potentials greater than the overall arc voltage) in the flux from the cathode region of vacuum arcs has been well established. While much excellent theoretical work has been done on the cathode region of a vacuum arc, only a modest amount of such work has predicted the energies of the ions leaving the cathode region. Two vacuum arc cathode theories which do predict the ion energies are the potential hump theory - where a positive space charge at the cathode spot accelerates the ions electrostatically, and the gas dynamic theory - where the ions are accelerated by a flow process. Few theorists have taken advantage of the available mass spectrometric data concerning individual ion energies. In this paper I compare such data with theoretical predictions. The best confirmed ion energy data is that for a copper cathode. Additional data is presented concerning the ion flux from a vacuum arc with a ten percent Bi/Cu cathode. Comparison of the copper and bismuth/copper data with the theoretical predictions shows that the potential hump and gas dynamic theories are in rough agreement with experiment, but are definitely not correct. Modifying the potential hump and gas dynamic theories by considering time-dependent phenomena (i.e., incorporating nonequilibrium states into the theory) is shown to offer the promise of bringing either theory into better agreement with experiment. I conclude that the available data on the energies of the ions leaving the cathode region of a vacuum arc can serve as strong constraints on theoretical analyses.

**39527 (JINR—9-82-541) Study on the intense relativistic electron beam propagation in a collisionless plasma of small density.** Korenev, S.A.; Rubin, N.B.; Khodataev, K.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701935.

9 refs.; 11 figs.; submitted to the journal Sov. J. Plasma Phys.

The results of the experimental studies of the intense relativistic electron beam (IREB) propagation with $\nu/\gamma$ approximately 0.1, and $\gamma$ approximately 1.6 ($\gamma$ is an electron beam relativistic factor) in a collisionless plasma of small density over the 180 cm length are presented. Plasma is generated with the incomplete discharge over dielectric surface at the residual gas pressure of P approximately $10^{-5}$ Torr. It is shown that the transportation efficiency may be essentially high, if the electron concentration in plasma satisfies the equilibrium conditions and if it is less or equal to the electron concentration in a beam. At concentration less than optimum one, the transportation efficiency decreases due to violations of equilibrium conditions. At high concentration the transportation efficiency also decreased due to the scattering and breaking on excited small-scale and plasma oscillations. The IREB propagation occurs without essential time delay under optimum conditions.

**39528 (UCRL—89156) Lecture notes for bulk and hourglass viscosities in wave propagation codes.** Hallquist, J.O. (Lawrence Livermore National Lab., CA (USA)). 6 May 1983. Contract W-7405-ENG-48. 22p. (CONF-830582—2). NTIS, PC A02/MF A01. Order Number DE83013042.

From Structural dynamics meeting; Ispra, Italy (16 May 1983).

Portions are illegible in microfiche products.

Viscosities, bulk and hourglass, are employed in most finite element and finite difference wave propagation codes and serve two distinct, unrelated functions. Bulk viscosities are used to treat shock waves. Proposed in one spat dimemsion by von Neumann and Richtmyer in 1950, the bulk viscosity method has since been used by nearly all developers of wave propagation codes. A viscous term, q, added to the pressure, has the effect of smearing shock discontinuities into rapidly varying but continuous transition regions. With this method the solution is unperturbed away from shocks, the Hugoniot jump conditions remain valid across the shock transition, and shocks are automatically treated wherever they arise in

the solution. This discussion of bulk viscosity draws heavily on works by Richtmyer and Morton, Noh, and Wilkins.

**39529 Coordinate system control: adaptive meshes.** Brackbill, J.U. (Los Alamos National Lab., NM). pp 277-294 of Numerical grid generation. Thompson, J.F. (ed.). New York, NY; Elsevier Science Publishing Co., Inc. (1982).

In the numerical solution of transient fluid flow problems, the flow variables are calculated at a finite number of points. The points form ordered arrays which are joined together in some systematic way to form a computation mesh. On this mesh the flow equations are approximated by finite differences, which are then marched in time. An adaptive algorithm is derived here from a minimum principle, and its application to transient flow problems in two dimensions is described. The major topics discussed are the variational formulation of a mesh generator with interior control, its use in adaptively rezoning a time-dependent problem, and the solution of the inverse problem to allow adaptive zoning of arbitrary initial meshes. (SC)

## 6450 High Energy Physics

**39530 (LPNHEX—81-19) Progress report 1981.** (Ecole Polytechnique, 91 - Palaiseau (France). Lab. de Physique Nucleaire et des Hautes Energies). [nd]. 40p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701684.

The activities of the laboratory during 1981 are briefly reported in high energy physics: neutrinos interactions, quark fusion in hadron interactions, photon interactions at high energy, instrumentation needed for new research programs.

## 6451 Particle Interactions And Properties - Experimental

*REFER ALSO TO CITATION(S) 39301*

**39531 (AC-Intern—81-05) Search for the sixth quark in hadronic final states of the electron-positron annihilation at PETRA.** Rykaczewski, H. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.; Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Aug 1981. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83750681.

Thesis.

Using the MARK-J detector at the PETRA storage ring hadronic final states of the electron-positron annihilation were studied. One aim of these measurements is mainly the search for a further quark, the top quark. The results yield no indications for bound state of the top quark in the energy range between 29.90 and 37.72 GeV. From the analysis of the spatial energy distribution of hadronic final states as well the rate of inclusive muon events also the result is obtained that top quarks are not produced below an energy of W=36.72 GeV.

**39532 (CEA-CONF—6313) Vector meson spectroscopy in p antip $\rightarrow e^+e^-X$.** Duclos, Jean. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1982. 7p. (CONF-8205103—8). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701686.

From Workshop on physics at LEAR with low energy cooled antiprotons; Erice, Italy (9 May 1982).

The vector meson data of the PS170 experiment, due to a high statistical accuracy and a clear $1^-$ signature should be very conclusive. Particularly, the open question of the rho'(1250) must be answered by such a measurement.

**39533 (DESY—82-083) Two-photon interactions.** Cords, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750672.

Talk presented at the 1982 SLAC summer institute on particle physics.

Recent spectroscopic results on f, $A_2$, and f' are reviewed and the suppression of the glueball candidate state THETA in the two-photon channel is discussed. A newly observed signal in the $\pi^+\pi^+\pi^-\pi^-$ invariant mass spectrum at 2.1 GeV is reported. Measurements on deep inelastic $e\gamma$ scattering show the expected point-like photon structure and allow to test the photon structure function $F_2$ for parton and QCD models. The observation of high Psub(T) jets from hard scattering processes is presented.

**39534 (IFVE-OEF—82-98) Polarization observation in the $\pi p p \rightarrow$ eta+n reaction at 40 GeV/c.** Avvakumov, I.A.; Apokin, V.D.; Vasil'ev, A.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701984.

Portions are illegible in microfiche products5 refs.; 5 figs.; 2 tabs.; Z. Phys.

The preliminary results of polarization measurements in the reaction $\pi^-$+ p$\rightarrow$ eta+n at 40 GeV/c for the 4-momentum transfers up to 1 $(GeV/c)^2$ are presented. Averaged value of the observed polarization in the t-range 0.5 <= excitation <= 1 $(Gev/c)^2$ is-(24+-8)%. The presented data are in contradiction with existing Regge model predictions.

**39535 (IFVE-OEIPK—82-119) anti $\Lambda$ hyperon polarization in the inclusive $K^+ p \rightarrow$ anti $\Lambda$+X reaction at 32 and 70 GeV/c.** Azhinenko, I.V.; Amaglobeli, N.S.; Balan, Zh.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701985.

Portions are illegible in microfiche products0 refs.; 2 figs.; 2 tabs.; submitted to the journal Phys. Lett.

Results on the inclusive polarization of anti $\Lambda$ hyperons produced in K+p interactions at 32 and 70 GeV/c are presented. A large positive anti $\Lambda$ polarization is observed in the kaon fragmentation region. The polarization is energy independent, increases strongly with increasing longitudinal momentum, but shows essentially no transverse momentum dependence. Inclusive total cross sections of anti $\Lambda$ production are found to be 0.42+-0.02 mb at 32 GeV/c and 0.65+-0.04 mb at 7O GeV/c.

**39536 (JINR—1-82-236) Prospects of investigations of muon interactions with nucleons and nuclei in TeV energy region.** Baldin, A.M.; Bardin, D.Yu.; Bilen'kij, S.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701987.

Paper copy only, copy does not permit microfiche production figs.

A program for studying deep inelastic scattering of TeV muons on nucleons and nuclei is considered. The aim will be to study the structure of elementary particles and dynamics of their interaction. The underlying physical problems are discussed. It is planned to study scaling violation, the structure functions of nucleons, polarization effects, weak neutral and charged currents, cumulative effects, and exotic states. The influence of radiative corrections will be studied. Considerations are presented of the setup constituents and the parameters of a muon beam. The time of performing some experiments is estimated. The research program is planned as an extrapolation of the scientific program which is being carried out in the joint JINR-CERN experiment.

**39537 (JINR—1-82-388) Comparative analysis of multiplicity distributions of shower particles emitted in proton-nucleus interactions at the 2-22 GeV energy range.** Vokal, S.; Shumbera, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702024.

The results of analysis of characteristics of s-particles emitted in interactions of protons with emulsion nuclei in the (2-22) GeV energy range are presented. It is shown that in this energy range approximate KNO-scaling is observed, better description is given by Buras function with $\alpha$=-0.243 parameter value. Some

multiplicity correlations of s- and h-particles are studied. It is shown that rather good description of the form of nsub(s)-distribution is obtained by the Poya-Egenberger function. It is shown that the parameter of this distribution comes on the plateau at energies of > or approximately 20 GeV.

39538 **(JINR-D—1-82-447) Space reconstruction of a charmed Λsub(c)sup(+) baryon production and decay vertices in nuclear emulsion.** Bunyatov, S.A.; Kuznetsov, O.M.; Lyukov, V.V.; Sidorov, V.M.; Ivanova, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701988.

Portions are illegible in microfiche products3 refs.; 2 figs.; 2 tabs.

The decay of charmed baryon Λsub(c)sup(+) → $pK^-\pi^+$ produced in the neutrino interaction with an emulsion nucleus has been observed. The Λsub(c)sup(+) mass is 2281+-12 MeV. The distance from the primary interaction vertex to the decay point is equal to 2.07+-0.70 μm. The time before decay equals (0.42+-0.14)x$10^{-14}$ s. When determining the Λsub(c)sup(+) range by the space reconstruction method the possibility has been demonstrated of using the information not only on X- and Y-but also on Z-coordinates of track grains. The described method can be applied to the search for new particles, among them beautiful ones, with lifetimes of order $10^{-14}$-$10^{-16}$ s in hybrid experiments.

39539 (JINR-D—2-81-158, pp 367-397) **Experimental state of the standard theory of electroweak interactions.** Petkov, S.T. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1981. (In Russian). Joint Inst. for Nuclear Research, Dubna, USSR. (CONF-8012108—).

From 14. international school of high energy physics for young scientists; Dubna, USSR (9 Dec 1980).

Paper copy only, copy does not permit microfiche production6 refs.; 10 figs.; 3 tabs.

Standard theory (ST) of weak current interactions (the Glashow-Weinberg-Salam theory) is tested on the basis of experimental data on weak, neutral and charged currents as well as decay of tau leptons and charmed mesons. The part of a coupling constant in the standard theory constructed on the SU(2)xU(1) calibration group has been discussed. Charged hadron and lepton currents and decays of exotic meson resonances have been considered within the framework of ST and a quark model. An experimental situation of the $\mu^-e^-$ pair production and the formation of strange meson resonances as well as lepton combinations arising during the $e^+e^-$ annihilation has been reviewed. tau$^{+-}$ leptons and νsub(tau) meson production and their properties have been studied. Summary of basic experimental and theoretical data relating to the tau$^{+-}$ and νsub(tau) production is given. The structure of neutral currents confirming the correctness of ST as the theory of weak current interactions has been studied. Experimental and theoretical values of phenomenological interaction constants at the Weinberg angle $\sin^2\theta=0.23$ are presented. The results obtained point also to the confirmation of ST predictions. Experimental data on the ee and eμ interactions with neutral currents as well as results of experiments on search for p-odd effects in Bi and Tl atoms have been discussed. In conclusion the experiments which are planned at the accelerators of the next generation have been talked over.

39540 (JINR-D—2-81-158, pp 498-522) **Present-day muon experiments.** Savin, I.A. 1981. (In Russian). Joint Inst. for Nuclear Research, Dubna, USSR. (CONF-8012108—).

From 14. international school of high energy physics for young scientists; Dubna, USSR (9 Dec 1980).

Microfiche only, copy does not permit paper copy reproduction7 refs.; 18 figs.; 5 tabs.

Investigations into the measurement of structure functions (SF) of nucleons in deep inelastic interactions carried on in 1979-1980 at the FNAL and CERN accelerator laboratories have been reviewed. The further study of the nucleon structure by means of muon reactions is more productive as compared with investigations with electron or neutron beams. The phenomenology of the deep inelastic scattering (DIS) has been investigated. It is shown that the calculation of SF of nucleons and their momenta with a quark-parton model is possible within the framework of asymptotically free gauge field theories, in particular QCD. There are two alternative ways of QCD prediction checking for the lepton DIS: direct usage of SF or using their momenta. Investigations into the muon DIS in CERN by means of magnetic spectrometers using a hydrogen target and iron are described in detail. Summary of preliminary data on the muon DIS obtained with $H_2$, Fe, Ca targets in the energy range of 90-280 GeV is given. Results of the evaluation of the highest twists effect on the results of the QCD analysis are presented. Totals of the analysis of now muon data are the following: 1. disturbance of a scaling hypothesis is confirmed; 2. the checking of the QCD predictions in the leading order from a coupling constant g gives a value of the parameter Λ=100 MeV with a possible systematic error approximately 100 MeV. The SF behaviour can be attributed to the highest twists only.

39541 **(JINR-R—1-82-252) Analysis of πpp interactions at 40 GeV/c by means of collective variables and problems of discriminating hadron jets.** Grishin, V.G.; Didenko, L.A.; Kanarek, T.I.; Metreveli, Z.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701989.

Portions are illegible in microfiche products1 refs.; 8 figs.; 1 tab.

The collective features of secondary particles are investigated in $\pi^-$p-collisions at 40 GeV/c. The mean value of collective variables sphericity, trust, alignment and planarity are determined. This values equal $< S > = 0.239+-0.002$, $< T > = 0.841+-0.001$, $< Q_2/Q_1 > = 0.175+-0.002$, $< Q_3/Q_2 > = 0.238+-0.002$, respectively. The behaviour of mean collective variables as a function of charged particle multiplicity nsub(ch) was studied. The experimental data are compared with the calculations for the spherical phase-space model and multiperipheral model. The evidence for two-jet structure of multihadron production in $\pi^-$p-interactions at 40 GeV/c for all charged particle multiplicity is reported. Good agreement with the multiperipheral model for small value nsub(ch) < 10 is obtained.

39542 **(JINR-R—1-82-333) Production of Λ0- and $K^0$-particles in interactions of $^4$He with $^6$Li nuclei at the momentum of 4.5 GeV/c per nucleon.** Anikina, M.Kh.; Bannik, B.P.; Vardenga, G.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702025.

The results of analysis are presented for $\Lambda^0$- and $K^0$-production in the interaction of $^4$He and $^6$Li nuclei at 4.5 GeV/c per nucleon. The values (5.9+-0.5) mb and (2.4+-0.6)x$10^{-2}$ are obtained for $\Lambda^0$-production cross section and for the ratio of $\Lambda^0$ and $\pi^-$ multiplicities; corresponding values for $K^0$-production appeared to be: (4.3+-1.2) mb and (1.6+-0.5)x$10^{-2}$. The mean values of momenta, transverse momenta, and rapidities were also determined from the characteristics of $\Lambda^0$ and $K^0$-particles produced in this interaction.

39543 **(JINR-R—1-82-363) Correlations in hadron-nuclear interactions accompanied by cumulative proton emission.** Lyubimov, V.B.; Solov'ev, M.I.; Sulejmanov, M.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702026.

The average characteristics of $\pi^-$$^{12}$C-interactions at Psub(π)=40 GeV/c accompanied by proton emission are studied as a function of the variable of "cumulativity" order (nsub(c)sup(max)). The correlations are observed only for the characteristics of secondary protons, and the region of cumulative proton production is singled out (nsub(c)sup(max) > 1.2). The characteristics of these interactions are discussed, and their cross sections are determined which are close to those for cumulative π-meson production. The conclusion is confirmed of independence of the processes of proton cumulative emission on those of π-meson cumulative emission. The data are obtained on invariant inclusive proton production cross sections as a function of their cumulative number as well as for interactions with different multiplicities of these protons. The work has been performed on pictures from the 2m propane bubble chamber of JINR.

**39544 (LAL—81-28) $e^+e^-$ annihilation at DCI with the magnetic detector DM1 for 1.4 < √S < 2.2 GeV. Discovery and study of phi' at √S = 1.65 with GAMMA = .15 GeV.** Delcourt, B.; Bizot, J.C.; Bisello, D. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Oct 1981. 13p. (CONF-810895—22). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701687.

From International symposium on lepton and photon interactions at high energies; Bonn, F.R. Germany (24 Aug 1981).

The phi' is discovered and studied in $e^+e^-$ annihilation into KK*, KantiK, $\omega\pi\pi$; the rho'is analysed with high statistics in $4\pi^{+-}$ and also in rhoeta, K*K, KantiK. Above √S = 1.8 GeV $e^+e^- \rightarrow K^*K\pi$ and $6\pi^{+-}$ are also observed. OZI rule is checked using $e^+e^- \rightarrow$ phi$\pi$, phi$\pi\pi$.

**39545 (LBL—15510) Parity nonconservation in atomic thallium: the magnetic-field experiment.** Drell, P.S. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 120p. NTIS, PC A06/MF A01. Order Number DE83013753.

Thesis.

An experiment underway to measure the parity-nonconserving electric-dipole amplitude in the 6³P/sub 1/2/ → 7³P/sub 1/2/ transition in atomic thallium is described.

**39546 (LPNHEX—82-02) Measurement of the transverse momentum of dimuons produced by hadronic interactions at 150, 200 and 280MeV/c.** Badier, J.; Boucrot, J.; Bourotte, J. (Ecole Polytechnique, 91 - Palaiseau (France). Lab. de Physique Nucleaire et des Hautes Energies). Jun 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701688.

We have studied the transverse momentum of dimuons in the mass internal 4.1 to 8.5 GeV/c² produced on hydrogen and platinum targets by different hadrons. For incident $\pi^-$, we give a model independent parametrisation of the data and compare our results to QCD perturbative calculations. First order diagrams predict a transverse momentum s dependence smaller than the observed value.

**39547 (SLAC—PUB-3118) Results from MAC.** Chadwick, G.B. (Stanford Univ., CA (USA)). May 1983. Contract AC03-76SF00515. 6p. (CONF-830231—1). NTIS, PC A02/MF A01. Order Number DE83012376.

From Europhysics study conference on electroweak effects at high energies; Erice, Italy (1 Feb 1983).

The MAC detector has been exposed at PEP to 40 $pb^{-1}$ luminosity of $e^+e^-$ collisions. The detector is described and recent results of a continuing analysis of hadronic cross section, lepton pair charge asymmetry, Bhabha process, two photon final state and radiative $\mu$ pairs are given. New results on flavor tagging of hadronic events with an inclusive $\mu$, and some searches for new particles are presented.

## 6452 Particle Interactions And Properties - Theoretical

**39548 (DESY—82-077) Jet production and fragmentation.** Wolf, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Nov 1982. 82p. (CONF-820718—36). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83750673.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

Jets produced by hard constituent scattering are clearly observed in $e^+e^-$ annihilation, deep inelastic lepton nucleon scattering and large psub(T) hadron hadron scattering. Amongst the most exciting results are the direct measurement of the parton-parton scattering angular distribution and the observation of very energetic jets at the SPS collider. QCD provides a consistent description for the underlying constituent scattering processes. The particle composition observed indicate similar fragmentation properties of quarks and gluons in $e^+e^-$ annihilation and lepton nucleon scattering.

**39549 (DOE/ER/02009—T5) Theoretical particle physics. Progress report, May 1, 1982-April 15, 1983.** Hendry, A.W.; Lichtenberg, D.B.; Weingarten, D.H. (Indiana Univ., Bloomington (USA). Dept. of Physics). Apr 1983. Contract AC02-76ER02009. 39p. (COO—2009-146). NTIS, PC A03/MF A01. Order Number DE83013341.

Our research activities for the past year have ranged from properties of hadrons in quark models to various aspects of grand unified theories and lattice QCD. Specific topics include studies of the hadron spectrum using several types of relativistic wave equations, the scattering of high energy particles from nuclei, intermediate energy scales in a grand unified theory based on SO(10), and calculating masses and decay constants in the valence approximation of lattice gauge theory.

**39550 (FERMILAB-CONF—83/35-Thy) Issues in the standard model.** Gaillard, M.K. (Fermi National Accelerator Lab., Batavia, IL (USA)). Apr 1983. Contract AC02-76CH03000. 14p. (CONF-830339—2). NTIS, PC A02/MF A01. Order Number DE83013846.

From Theoretical symposium on intense medium energy sources of strangeness; Santa Cruz, CA, USA (19 Mar 1983).

Focussing on the standard electroweak model, we examine physics issues which may be addressed with the help of intense beams of strange particles. I have collected miscellany of issues, starting with some philosophical remarks on how things stand and where we should go from here. I will then focus on a case study: the decay $K^+ \rightarrow \pi^+$ + nothing observable, which provides a nice illustration of the type of physics that can be probed through rare decays. Other topics I will mention are CP violation in K-decays, hyperon and anti-hyperon physics, and a few random comments on other relevant phenomena.

**39551 (IC—80/96) Study of factorization in QCD with polarized beams and a production at large psub(T).** Craigie, N.S.; Baldracchini, F.; Roberto, V.; Socolovsky, M. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1980. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701679.

We discuss what aspects of the leading orders in QCD could be tested in the large psub(T) reactions p-bar-vectorp → A-vector + X, p-barp-vector → A-vector + X and p-bar-vectorp-vector → Λ + X.

**39552 (IC—80/105) Proton mass doublet from general relativity.** Sachs, M. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1980. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701624.

This paper discusses features of the proton mass according to the author's non-linear, spinor field theory in general relativity. Within its context, where mass doublets are generally predicted for all spinor matter fields, it is shown, in a semi-quantitative fashion, that 1) in addition to the normal (stable) proton, there is a heavier proton that has a mass of order 193 GeV, and 2) a fundamental constant, gsub(m) approx. $2.087.10^{-14}$ cm, that was determined earlier from a more general version of electrodynamics in which a short-range part plays a role in the nucleon domain, leads to a prediction of the normal proton mass that is within 1.0% of its empirical value.

**39553 (IC—80/110) Composite quarks and their magnetic moments.** Parthasarathy, R. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1980. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701625.

A composite quark model based on the symmetry group SU(10)sub(flavour) x SU(10)sub(colour) with the assumption of mass non-degenerate sub-quarks is considered. Magnetic moments of quarks and sub-quarks are obtained from the observed nucleon magnetic moments. Using these quark and sub-quark magnetic moments, a satisfactory agreement for the radiative decays of vector mesons (rho,ω) is obtained. The ratio of the masses of the sub-quarks constituting the u,d,s quarks are found to be Msub(p)/Msub(n) = 0.3953 and Msub(p)/Msub(lambda) = 0.596, indicating

a mass hierarchy Msub(p) < Msub(n) < Msub(lambda) for the subquarks.

39554 **(IC—80/133) Landau theory and Ginzburg criterion for interacting bosons.** Singh, K.K. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1980. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701626.

Starting with a microscopic Hamiltonian for a system of interacting bosons, and using perturbation theory, a Landau type theory is developed to describe the system in the vicinity of the Bose-Einstein transition curve. The theory is, however, seen to be valid only if the dimensionality d of the system is larger than 4; for $d < 4$, higher order graphs make divergent contributions. An attempt to remove the divergences in a self-consistent manner yields Ginzburg's criterion for the validity of the Landau theory.

39555 **(IC—80/161) Empirical verification of recently proposed hadron mass formulas.** Mielke, E.W. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1980. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701673.

For the nucleon resonances as well as for the heavy vector mesons different mass formulas are compared. Those corresponding to a band of rotational excitations of the particle seem to agree rather well with the existing data.

39556 **(IC—80/168) Heavy mesons in a simple quark-confining two-step potential model.** Kulshreshtha, D.S.; Kaushal, R.S. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1980. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701674.

We study the mass spectra and decay widths of upsilon resonances in a simple quark-confining, analytically solvable, two-step potential model used earlier to study the charmonium system and even the light mesons like $\pi$, rho, $K$,... etc. Results are found to be in good agreement with experiments and also with the values predicted by others. We also calculate within our model, the masses of the lowest-lying bottom mesons which we denote by B($\pi$) or B, B(rho) or Bsup(*), B(K) or Bsub(s), B(Ksup(*)) or Bsub(s)sup(*) and B(psi) or Bsub(c); showing that these agree well with the other theoretical predictions. In this way we put the BB-bar threshold at 10.242 GeV, which means in our model the first three radial upsilon excitations, viz. Y(9.4345), Y'(9.9930) and Y''(10.1988) are stable with respect to the Zweig allowed decay Ysup('''...) → B-barB.

39557 **(IC—80/169) Form factor of K meson and the meson radii in a quark-confining two-step potential model.** Kulshreshtha, D.S.; Kaushal, R.S. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1980. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701675.

Previous two-step potential model calculations for the pion form factor in the space-like region are now extended to include the form factor of K meson, in an anticipation that the experimentalists will shortly be able to measure it for $q^2$ up to say 2.0 GeV$^2$ also, as Dally et al. have already measured it for $q^2$ up to 0.2 GeV$^2$. Although the curve does not fit the present experimental data ($q^2$ up to 0.2 GeV$^2$) well, it is anticipated that the model will probably fit the experimental data fairly well for slightly higher values of $q^2$ say, up to 2.0 GeV$^2$, when measured, as it does, very successfully, in the case of pion over a wide range of momentum transfer $q^2$.

39558 **(IC—80/175) High energy multi-gluon exchange amplitudes.** Jaroszewicz, T. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1980. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701676.

We examine perturbative high energy n-gluon exchange amplitudes calculated in the Coulomb gauge. If n exceeds the minimum required by the t-channel quantum numbers, such amplitudes are non-leading in lns. We derive a closed system of coupled integral equations for the corresponding two-particle n-gluon vertices, obtained by summing the leading powers of ln(N $\mu$ psup($\mu$)), where psup($\mu$) is the incident momentum and Nsup($\mu$) the gauge-defining vector. Our equations are infra-red finite, provided the external particles are colour singlets.

39559 **(IC—80/180) Preon model with hidden electric and magnetic type charges.** Pati, J.C.; Salam, A.; Strathdee, J. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1980. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701630.

The U(1) x U(1) binding forces in an earlier preonic composite model of quarks and leptons are interpreted as arising from hidden electric and magnetic type charges. The preons may possess intrinsic spin zero; the half-integer spins of the composites being contributed by the force field. The quark-lepton gauge symmetry is interpreted as an effective low-energy symmetry arising at the composite level. Some remarks are made regarding the possible composite nature of the graviton.

39560 **(IC—80/183) Probings through proton decay and n-n-bar oscillations.** Pati, J.C.; Salam, A.; Strathdee, J. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1980. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701677.

Violation of baryon, lepton and in general fermion number is central to the hypothesis of quark lepton unification in a gauge context. Three of its characteristic signatures are proton decay, n-n-bar oscillation and neutrinoless double $\beta$ decay. In 1974 and 1975 it was shown that within maximal gauging the proton may decay via four alternative modes (i.e. proton → one or three leptons or antileptons) satisfying $\Delta F = -2, 0, -4$ and $-6$, some of which may coexist; the deuteron may decay into pions and neutrinoless double $\beta$ decay occur in the context of spontaneous gauge symmetry breaking. It is now observed that n-n-bar oscillations (which are related to deuteron decays into protons) can coexist with proton decay especially of $\Delta F = -4$ variety ($p \rightarrow e^+\pi^0$) and both these processes may possess measurable strength so as to be amenable to forthcoming searches. We exhibit alternative routes for spontaneous breakdown of the maximal one-family symmetry SU(16) and show that the coexistence of alternative proton decay modes (even with n-n-bar oscillations) does not pose any conflict with cosmological generation of baryon excess. Spontaneous rather than explicit violation of B, L and F plays an essential role in the realization of these features.

39561 **(IC—80/186) O(5) x U(1) electroweak theory.** Mukku, C.; Sayed, W.A. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1980. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701631.

An anomaly free O(5) x U(1) theory of electroweak interactions is described which provides a unified description of electroweak phenomena for two families of standard leptons and quarks. No "new" non-sequential type fermions of the standard model are introduced as has been the case for all past studies based on this group. The present scheme requires the introduction of two further charged and three more neutral gauge fields over and above the Wsup(+-), Z and photon fields of SU(2) x U(1) giving rise to new neutral and charged currents. In this note we outline our reasons for proposing the present electroweak scheme, give the basic structure of the model, discuss the symmetry breaking pattern which ensures that SU(2)sub(L) x U(1) is the low energy symmetry, point out the new interactions present in the extended framework and obtain limits on the masses of all the gauge fields.

39562 **(IC—80/190) Model independent dispersion approach to proton Compton scattering.** Caprini, I.; Guiasu, I.; Radescu, E.E. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1980. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83701678.

The proton Compton scattering at low and intermediate energies is studied by means of a dispersion framework which exploits in an optimal way the (fixed momentum transfer) analyticity properties of the amplitudes in conjunction with the consequences of the (s-channel) unitarity. The mathematical background of the work consists of methods specific to boundary value problems for analytic vector-valued functions and interpolation theory. In comparison with previous related work, the external problems to be solved now are much more difficult because of the inclusion of the photoproduction input and also lead to additional computational complications. The lower bounds on the differential cross-section, obtained

without any reference to subtractions and annihilation channel contributions, appear sufficiently restrictive to evidentiate rigorously some inconsistencies between results of single pion photoproduction multipole extractions and proton Compton scattering data.

**39563 (IC—81/143) Lepton pair production in deep inelastic scattering of polarized particles.** Hongan, P.; Danhua, Q. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1981. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701680.

Using the leading order nucleon density function of QCD, we have calculated the differential cross sections and the helicity asymmetries Asub(L)(M²) associated with definite initial helicity states in e(μ)+P→e(μ)+γsup(*), Z°+X→e(μ)+ll-bar+X at two energy ranges. The differential cross sections are too small to measure, but the integrated helicity asymmetry may be a measurable quantity which could be a clear test about the existence of Z° particle. We also show that the contributions of LPP where γsup(*),Z° radiated from e(μ) lepton lines are important when lepton pair mass M < or approx. 5 GeV., but becomes tiny as M is approximately equal to Msub(Z).

**39564 (IC—81/155) Pairing in hadron structure.** Chela-Flores, J. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1981. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701635.

A many-body approach to hadron structure is presented, in which we consider two parton species: spin-0 (b-partons), and spin-1/2 (f-partons). We extend a boson and a fermion pairing scheme for the b-, and f-partons respectively, into a Yang-Mills gauge theory. The main feature of this theory is that the gauge field is not identified with the usual gluon field variable in QCD. We study the confinement problem of the hadron constituents, and obtain, for low temperatures, partons that are confined by energy gaps. As the critical temperatures for the corresponding phase transitions are approached, the energy gap gradually disappears, and confinement is lost. The theory goes beyond the non-relativistic harmonic oscillator quark model, in the sense of giving physical reasons why a non-relativistic approximation is adequate in describing the internal dynamics of hadron structure.

**39565 (IC—81/169) Penguin effects in ΔS not equal to 0 B decays in a five flavour SU(2)xU(1) model.** Kamath, S.G. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1981. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701636.

The leading QCD corrections to the tree level interaction density for the ΔS not equal to 0, ΔB not equal to 0 couplings in an SU(2)xU(1) five flavour model due to Gorn and Paschos are evaluated.

**39566 (IFVE-ONF/FTO/PK—150) Screening of electroweak interactions and superweak effects in rare processes.** Liparteliani, A.G.; Monich, V.A.; Volkov, G.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701953.

Microfiche only, copy does not permit paper copy reproduction3 refs.; 4 figs.; 3 tabs.

The screening of electroweak forces for the class of rare processes is studied. The screening proves to be a consequence of horizontal symmetry of these interactions with respect to quark-lepton generations. A model of gauge superweak horizontal interactions is considered. Probabilities to find processes relating to superweak forces are being analyzed in the framework of this model. Possible contributions of horizontal interactions into experimentally observed parameters of rare ND-processes are obtained. This allows one to regard the following three types of processes: ΔH=0, Ksub(L, S)sup(0) → $\mu^- e^+ (e^- \mu^+)$..., ΔH=1, Ksub(L, S)sup(0) → $e^+ e^-$, $\mu^+ \mu^-$; μ → eγ, μ → 3e, ...; ΔH=2, K° reversible anti K°, D° reversible anti D°, $\mu^- e^+$ reversible $\mu^+ e^-$, ... where H is a horizontal quantum number.

**39567 (IFVE-OTF—81-105) Model without t quark from the view point of new experimental data.** Grigoryan, S.S.; Sultanov, S.F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701954.

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It is shown, that the models without t quark with arbitrary number of down quarks based on the SU(2) x U(1) symmetry of electroweak interaction are in agreement with experimental data on B(b anti q)-meson decay branching ratios if a right-handed doublet (c,b)sub(R) is introduced. The mentioned data can also be described within the framework of SU(2)sub(L)xSU(2)sub(R)xU(1) models, without t quark, which naturally arise in the grand unification theories, based on the exceptional groups.

**39568 (IFVE-OTF—82-26) Quark and jet charge relation.** Kartvelishvilli, V.G.; Roinishvili, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701955.

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Relations between quark and hadron jet charges are obtained. It is shown that the additive quantum numbers of hadronic jets, averaged over many events, correspond to the quantum numbers of the quark-initiator if the baryon number of the jets is equal in average to the baryon number of the quark. Equations relating quark charges with mesonic and baryonic jet charges may be useful for a nontrivial test of the quark-parton model.

**39569 (IFVE-OTF—82-43) Two-Regge model and new data on inclusive hadron production in anti pp interactions at √S=540 GeV.** Likhoded, A.K.; Tolstenkov, A.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701956.

9 refs.; 1 fig.; 2 tabs.

Comparison of calculations in framework of the Regge model with the new data on $\pi^{+-}$, $K^{+-}$, P and anti P hadron production in anti PP collisions at the energy √S=540 GeV. The quantitative predictions of the model for the sum particle distribution on a rapidity are shown to be 25 lower than the experimentally measured values. It has also been shown that the disagreement in the given approach can't be explained by the effects connected with the total cross section growth.

**39570 (IFVE-OTF—82-44) Model of fast growth and pion charge exchange reaction on protons at small momentum transfers.** Siksin, V.V.; Shchelkachev, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701957.

Portions are illegible in microfiche products8 refs.; 7 figs.; submitted to the journal Sov. J. Nucl. Phys.

The possibility of using the model of fast growth (MFG) for describing experimental data on pions charge exchange on protons at small momentum transfers is considered. An assumption is put forth on the logarithmic growth with the Coulomb phase energy in elastic $\pi^{+-}$p scattering. The description of the model is given and the method of taking into account radiative corrections to the amplitude of $\pi^{+-}$p scattering at small angles is described. It is shown that MFG permits to describe well all experimental data available on charge exchange at momenta P lab. > 6 GeV/c including the recent Serpukhov data on polarization at P lab. = 40 GeC/c.

**39571 (IFVE-OTF—82-90) Neutral currents in the SU(3)xU(1) electroweak model.** Dubinin, M.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701958.

Portions are illegible in microfiche products6 refs.; 1 tab.; submitted to the journal Sov. J. Nucl. Phys.

The SU(3)xU(1) electroweak model which is consistent with the neutral current data on $\nu N$, $\nu e$, polarized eN scattering is discussed. Masses of the two neutral gouge bosons included in the theory are of the same order. Masses of gauge fields are defined Lagrangian interactions of gauge mesons with fermions are discussed.

39572 **(ITEF—122(1981)) Possibility of measurement of particle polarization according to their correlations at small relative momentum.** Degtyarenko, P.V.; Leksin, G.A.; Stavinskij, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701986.

8 refs.; 2 figs.; 1 tab.

Method for measuring the particle correlation for small relative momentum is suggested. The method idea as applied to protons, consists in the fact that the correlations between protons are different for parallel or antiparallel spin orientation. The calculation of the proton polarization having 0.32-0.63 GeV/c momentum recorded in the p-Al, p-Cu and p-Pb interactions at 8.3 GeV/c momentum is given. The polarization determination accuracy obtained are comparable with the existing data.

39573 **(ITEP—26(1982)) Hadronic shifts and widths of multiquark dibaryons with Y=1.** Kerbikov, B.O. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701959.

Portions are illegible in microfiche products5 refs.; 9 figs.; 1 tab.

Hadronic shifts and widths of multiquark dibaryons with Y=1 are considered in the framework of the bag model. For the bag model eigenstates with B=2, Y=1 the shifts and widths caused by their coupling to the S-wave $\Lambda N$ and $\Sigma N$ channels are determined. To describe the coupling between the quark-model eigenstates and the hadronic channels and the interaction in the hadronic channel the P-matrix formalism is exploited. The overall structure of the P matrix and the values of its parameters are obtained by means of the SU(3) group.

39574 **(ITEP—27(1982)) Pion form factor at intermediate momentum transfer in QCD.** Ioffe, B.L.; Smilga, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701960.

Portions are illegible in microfiche products2 refs.; 6 figs.

A general method is proposed for the QCD based calculation of form factors at intermediate $Q^2$ and of the partial widths of the low-lying meson resonances. The basic idea is to use QCD sum rules for the vertex functions. With this method, the pion form factor at $0.5 <$ or approximately $Q^2 <$ or approximately 3 $GeV^2$ is calculated. The results are in good agreement with experiment.

39575 **(ITF—82-20-R) Calculation of the $2 \rightarrow 3$ processes in quantum chromodynamics by the invariant integration method.** Duplij, S.A.; Pekalo, M.P. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1982. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701961.

Portions are illegible in microfiche products8 refs.; 3 figs.

The energy and angle distributions of Q anti Q-pair are found in the processes q anti $q \rightarrow Q$ anti Qg in the framework of a tree approximation where g is a gluon, q=u, d, s are light and Q is heavy quarks. The quantitative analysis of various Q anti Q-pair distributions in hadronic collisions is carried out. Differen-- tial cross sections of the processes are determined.

39576 **(ITP—81-143-E) Mass formulal from broken SU(N). 1. Mesons.** Shirokov, V.A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1981. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701962.

Portions are illegible in microfiche products2 refs.

A simple formalism for obtaining the mass formulae of particles within a broken SU(N)-symmetry of hadrons is proposed. An equivalence of different methods of unitary symmetry breaking is found on the basis of the developed approach. The mass formulae for a $(N^2-1)$-plet of mesons generalizing the known Gell-Mann-Okubo relations for the case of particles characterized by an arbitrary number of flavours are obtained.

39577 **(JINR—E-2-82-36) Structure functions of pseudoscalar mesons in a composite model with QCD interaction.** Kapshay, V.N.; Linkevich, A.D.; Skachkov, N.B.; Savrin, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701964.

Microfiche only, copy does not permit paper copy reproduction5 refs.; 3 figs.; submitted to the journal Theor. Math. Phys.

The analysis of scaling properties of structure functions of the deep-inelastic scattering of an electron on a hadron in the framework of quantum field theory is carried out. The approximate solutions are found for the quasipotential equation for the wave function of a quark-antiquark system with the interaction quasipotentials taken in the form of the one-photon and one-gluon exchange amplitudes. These solutions are applied to obtain an explicit form of the meson structure functions and for a numerical analysis of the scaling violation in a preasymptotic region.

39578 **(JINR—E-2-82-195) Insight into the parity violation at $\pi$NN vertex.** Dubovik, V.M.; Zenkin, S.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701963.

Portions are illegible in microfiche products2 refs.; 1 fig.; 1 tab.

Asub($\pi$)=A($n \rightarrow \pi^- p$) parity-violating amplitude is considered. Within the field-theoretical approach it is shown that canonical ETC-part (where ETC is the equal time commutator) of Asub($\pi$) corresponds to nonfactorizing (NF) diagrams. Asub($\pi$)sup(NF) may be calculated for the total effective Hamiltonian in SU(2)sub(L) x U(1) x SU(3)sub(C) theory via the SU(3) sum rule and is very sensitive to the behaviour of running QCD constant asub(s)($\mu$) at $\mu <$ or approximately msub(c) (msub(c) is mass of c-quark). It is argued that the contribution of factorizing diagrams into Asub($\pi$) is negligible.

39579 **(JINR—E-2-82-542) Glashow-Weinberg-Salam model without scalar fields.** Hosek, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701965.

Portions are illegible in microfiche products9 refs.; 4 figs.; submitted to the journal Nucl. Phys.

Standard SU(2)sub(L) x U(1)sub(Y) Glashow-Weinberg-Salam GWS model without scalar fields is supplemented with the heavy Abe-- lian vector boson C, which interacts with all fermions of both chiralities. The problem of the dynamical fermion mass generation is solved in the Hartree-Fock-Bogolubov approximation applied to the effective four-fermion interaction. The effective interaction between the dynamical Goldstone bosons and the gauge bosons is calculated, which leads in a standard manner to the masses of W and Z vector bosons. The masses msub(W) and msub(Z) are thus related to the fermion masses and to the measurable mixing angles of the right-handed fermions. The physical current, to which the vector boson C couples, is not flavor diagonal.

39580 (JINR-D—2-81-158, pp 9-35) **Integer-charged quarks and spontaneously broken color symmetry.** Tavkhelidze, A.N. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1981. (In Russian). Joint Inst. for Nuclear Research, Dubna, USSR. (CONF-8012108—).

From 14. international school of high energy physics for young scientists; Dubna, USSR (9 Dec 1980).

Microfiche only, copy does not permit paper copy reproduction4 refs.; 5 figs.

Available experimental data confirming the character of the symmetry breaking in strong and electromagnetic interactions of hadrons and leptons have been discussed to corroborate SU(3)xU(1) colour symmetry breaking. A unified gauge model with spontaneously broken symmetry with the given set of scalar fields and integer-charged quarks (ICM) has been suggested. Within the framework of ICM considered was the asymptotic behaviour of the relation of the total cross section of electron-positron annihilation to hadrons and the total cross-section of annihilation to muons Rsub(s); rules of sums at finite energies for Rsub(s) have been constructed and a series of restrictions in the model parameters has been obtained on their basis. As the "screening" mechanism of integer-charged quarks does not fulfil for processes with the photon participation and large transfers of momenta considered were radiation decays of mesons into photons and radioactive corrections (RC) for these processes have been calculated. The RC evaluations obtained for the Born approximation point to the inapplicability of the perturbation theory to calculations of probability of these processes. Considered was a problem of the contribution of the vacuum hadron polarization to the anomalous magnetic momentum of muon (a. m. m.) and a total value of this momentum has been evaluated. The following conclusions have been drawn: a) colour symmetry disturbance is possible only at energies significantly lower than energies for which the property of the asymptotic freedom is true; b) in this case a strong coupling at large distances is realized and theory predictions can be coordinated with experimental data on the $e^+e^-$ annihilation to hadrons, radiation decays of heavy mesons and a value of the framework of ICM comes to the problem of the complete or partial confinements of quarks.

39581 (JINR-D—2-81-158, pp 237-264) **Dynamics of strong interactions. 2. Study on the exclusive processes with large momentum transfers in quantum chromodynamics.** Goloskokov, S.V. (Joint Inst. for Nuclear Research, Dubna (USSR)); Matveev, V.A. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1981. (In Russian). Joint Inst. for Nuclear Research, Dubna, USSR. (CONF-8012108—).

From 14. international school of high energy physics for young scientists; Dubna, USSR (9 Dec 1980).

Portions are illegible in microfiche products3 refs.; 8 figs.

This lecture is devoted to the discussion of the status of power laws in particle physics, particular example of which are the rules of the quark counting. A problem of developing of successive methods for describing the asymptotical behaviour of hadron interaction amplitudes with large transfers of pulses within the framework of the perturbation theory of quantum chromodynamics (QCD) is discussed. A method for the dynamic description of compound systems in QCD accomplished on the basis of three-dimensional equations of a wave function related to the Bethe-Salpeter calibration-invariant two-point amplitude during the fixed choice of a contour shape has been suggested. The contribution of one-gluon exchange diagrams to the interaction quasipotential has been evaluated. It is shown using as an example the calculations of the electromagnetic pion formfactor in the pulse approximation how the described theory of the compound systems in QCD permits to investigate the asymptotic behaviour of hadron formfactors during large transfers of pulses. Angular dependences of binary reactions in QCD such as elastic scattering of a pion with a proton or a quark with a pion have been studied. The study on the angular dependence of the binary reactions results in the establishment of generalized rules of the quark counting, determining main contributions to the asymptote of the differential cross section of scattering in the range of large angles in terms of topologies of different quark diagrams corresponding to the given process.

39582 (JINR-D—2-81-158, pp 319-333) **Quark-gluon jets.** Dremin, I.M. (AN SSSR, Moscow. Fizicheskij Inst.). 1981. (In Russian). Joint Inst. for Nuclear Research, Dubna, USSR. (CONF-8012108—).

From 14. international school of high energy physics for young scientists; Dubna, USSR (9 Dec 1980).

Microfiche only, copy does not permit paper copy reproduction8 refs.; 6 figs.

Theoretical representations of the production, evolution and transformation of quark-ion jets to hadrons are reviewed. Available experimental data in the energy region from 13 to 32 GeV have been discussed in detail. These data detect hadron jets in the $e^+e^-$ annihilation, in deep inelastic lepton-hadron processes and in hadron-hadron and (pp) interactions. It is shown that hadron multiplicity in the $e^+e^-$ annihilation increases rapidly with energy and the distribution in jets T in *vp* processes has maximum in the range T approximately O.8-0.9. Study of pp interactions in emulsions at 200 GeV has shown the jet character of particle production. Jet production mechanisms in all the interactions considered have been examined at the level of quark-gluon representations. The evolution of the quark-gluon jets has been described within the framework of quantum chromodynamics. It is shown that the calculations in the lower order of QCD don't result in the agreement with the experiments. It is shown that the jet evolution changes considerably at the finite stage for comparatively small masses of partons. Problems of the transformation of the quark- gluon jet to the hadron jet from the point of view of cluster formations (preconfinement) and the effect of hadronization for modern energies have been disussed in short. It is underlined that in spite of the general successful description of the jet evolution in the $e^+e^-$ annihilation process there are many unsettled problems for each state of the jet development.

39583 (JINR-D—2-81-158, pp 412-427) **Unified gauge theories and the problem of the origin of baryon asymmetry.** Ignat'ev, A.Yu.; Kuz'min, V.A.; Shaposhnikov, M.E. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1981. (In Russian). Joint Inst. for Nuclear Research, Dubna, USSR. (CONF-8012108—).

From 14. international school of high energy physics for young scientists; Dubna, USSR (9 Dec 1980).

Microfiche only, copy does not permit paper copy reproduction2 refs.; 2 figs.

Explanation of origin of the Universe baryon asymmetry (UBA) has been attempted within the framework of united gauge theories (UGT) of strong, electromagnetic and weak interactions. Different approaches to the UBA formation problem have been discussed. Considered was the most natural approach from the point of view of particle physics: the singular state of the baryon-antibaryon system is symmetrical but the baryon number and CP invariance are not retained and UBA arises in processes with elementary particles at the thermodynamically nonequilibrium stage of the Universe expansion. A UBA generation mechanism based on a hypothesis of the thermodynamic equilibrium in the expanded Universe at the expense of quantum-gravitational interactions is suggested. A problem of the explanation of the UBA existence with the synthesis of UGT and of the theory of the hot Universe was investigated in detail. Macroscopic factors of the baryon asymmetry suppression in deacys of vector and scalar particles have been determined. The baryon asymmetry calculations have been performed within the framework of the SU(5) model with the Higgs expanded sector. In is concluded that within the framework of UGT, on the assumptions of scalar particle masses, a possibility for explaining the asymmetry value, the calculated value of which is close to the value observed experimentally, appears.

39584 (JINR-R—2-81-833) **Bag model with a power confining potential.** Bogolyubov, P.N.; Dorokhov, A.E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701966.

Portions are illegible in microfiche products3 refs.; submitted to the journal Sov. J. Nucl. Phys.

The bag model is generalized to the case of any confining potential. The equations of motion and the boundary conditions are formulated. The solution of a model of static confining potential in the one-dimensional case is obtained. Using this solution the structure functions for scalar currents are calculated. The functions obtained behave as 1/xi in the case of small scaling variable $xi=-q^2/2pq$. This property is like to be characteristic for the linear potential.

**39585 (JINR-R—2-82-44) Probability current density for neutral particles with 1/2 spin.** Strel'tsov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701972.

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Some specific properties of using real wave functions to describe neutral particles within the quantum mechanics framework are described. In particular basing on the Majorana representation solutions of Dirac equation as plane waves and Dirac 4-vector probability current jsup(k) are considered. It is shown that in the case under discussion jsup(k) (for particles with m not equal to 0 mass) is "light vector" jsup(k)jsub(k)=0.

**39586 (JINR-R—2-82-50) Selection rules and intrinsic characteristics of elementary particles.** Zyong Van Fi; Nguen Mong Zao. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701973.

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The isotopic selection rules for the decays of elementary particles in accounting the intrinsic characteristics of the hadrons, leptons, photons and spurions are obtained. It is proved that they are in good accordance with all observed decays of $\mu$-, r-, $\pi$-, eta-, n-, K-, LAMBDA-, $\Sigma$-, $>$- and $\Omega$-particles. The connection between the above mentioned rules and the rules $\Delta$Qsup(a)=$\Delta$Ssup(a), $\Delta$Ssup(a)=1 and $\Delta$Isup(a)=1/2. is considered. Some cases, including a semileptonic decay with $\Delta$Qsup(a)=$\Delta$Ssup(a) breaking are illustrated.

**39587 (JINR-R—2-82-59) Hadron fragmentation and quark recombination in hadron-nuclear interactions.** Lykasov, G.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701975.

Microfiche only, copy does not permit paper copy reproduction4 refs.; 5 figs.; submitted to the journal Sov. J. Nucl. Phys.

Within the additive quark model the contribution of recombination of rescattered quark components into invariant spectra of mesons and baryons produced in p-A collisions at high energies in the region of large longitudinal and small transverse momentum components of generated hadrons is calculated. It is shown that making allowance of quark single scatterings inside a nucleus is not sufficient, and one should also consider contributions of quark collisions of a higher multiplicity.

**39588 (JINR-R—2-82-181) Interference correlations in a 4 pion system.** Lednicky, R.; Podgoretskij, M.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701967.

8 refs.; 3 figs.

The interference correlations specific for an independent emission of four pions are discussed. It is shown that the correlations in the systems $2\pi^+2\pi^-$ and $2\pi^0\pi^+\pi^-$ differ from those in the system of two, as well as four identical pions. A comparison with the correlations in the production of two resonances, each of them decaying two pions, is done. The conditions leading to the correlations in pairs of unlike pions are discussed.

**39589 (JINR-R—2-82-274) Forbidden nucleon decays in the SU(5/1) superunification.** Dao Vong Dyk, Nguen Tkhi Khong. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701968.

Portions are illegible in microfiche products0 refs.

The nucleon decays are considered in the framework of the unified theory of strong, weak and electromagnetic interactions based on the SU(5/1) supergauge group. It is shown that H-invariance (H being the generator of the U(1) subgroup) leads to the suppression of numerous baryon-nonconserving decays. This result does not depend on the nature of symmetry breaking of SU(5) and, among the others, could be used for the experimental test of the theory.

**39590 (JINR-R—2-82-323) Neutrino-nucleus interactions and secondaries formation.** Eliseev, S.M.; Yuldashev, B.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702028.

Results are presented for the analysis of characteristics of pions and protons produced in interactions of high-energy neutrinos with neon nuclei. The calculation was made by the Monte-Carlo method. It is shown that main characteristics of secondary hadrons are satisfactorily described by the cascade model. It has been assumed that cross sections of the interaction of secondaries with the nucleus nucleons grow exponentially, the exponential coefficient being equal to approximately 0.4-0.94 GeV.

**39591 (JINR-R—2-82-327) Interference correlations in a "resonance plus particle" system.** Lednicky, R.; Podgoretskij, M.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701969.

7 refs.; 4 figs.

The correlations in a three-particle system are considered in the case when two of the particles are the resonance decay products, and when the third particle and resonance are produced independently in different space-time points. It is shown that in such processes, besides the usual correlations of like particles, there appear the correlations between unlike particles and also between the particle and the resonance. The character of these correlations is determined by the resonance decay range as well as by the dimension of the particle production region.

**39592 (JINR-R—2-82-338) $A_1$-meson mass and decays in the model with quark loops.** Volkov, M.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701970.

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Based on the effective Lagrangian with four-quark interaction the widths of the decays $A_1 \rightarrow$ rho$\pi$ and $A_1 \rightarrow$ epsilon$\pi$ are calculated and estimates of the $A_1$ mass are made. It is discovered that the value of the $A_1 \rightarrow$ rho$\pi$ decay width is insensit+ve to the change of the mass value of the $A_1$-meson in the limits from 1150 to 1250 MeV and is equal to GITAsub(Asub(1)) $\rightarrow$ rho$\pi$ approximately 150 MeV. On the contrary, the $A_1 \rightarrow$ epsilon$\pi$ decay width changes quickly with changing masses of the $A_1$- and epsilon mesons. Therefore, a more accurate measurement of the $A_1 \rightarrow$ epsilon$\pi$ decay width allows to obtain more exact estimates of the $A_1$ and epsilon masses. The rigorous inequality is also received for the squares of the $A_1$-, epsilon- and $\pi$-meson masses.

**39593 (JINR-R—2-82-356) pp- and anti pp elastic scattering in the meson-cloud model.** Goloskokov, S.V.; Kuleshov, S.P.; Selyugin, O.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701971.

Microfiche only, copy does not permit paper copy reproduction6 refs.; 6 figs.

High-energy elastic hadron-hadron scattering at small angles is considered within the spinless meson-cloud model Using a modified version of the model, i. e., taking into account the contribution of heavy mesons into the meson cloud and terms of order $1/\sqrt{s}$ in the scattering amplitude, a unique qualitative description of ranges of small and large transfer momenta in considering the whole available set of experimental data for Psub(L) $>=$ 200 GeV are obtained. Predictions are found for differential cross sections of proton-antiproton scattering in a wide momentum transfer region. The results obtained explain the presence of the diffraction minimum in the proton-antiproton scattering at Psub(L) = 50 GeV.

**39594 (JINR-R—2-82-560) Generalized WKB-solution of the quasipotential scattering problem for scalar particles.** Gogokhiya, V.Sh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 7p. (In Russian). (CONF-8205174—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701974.

From International conference on Quarks-82; Sukhumi, USSR (1 May 1982).

8 refs.; 2 figs.

Quasipotential Coulomb scattering problem of scalar particles of equal masses is considered. In this case the integral quasipotential equation for partial amplitudes is reduced to the Sturm-Liouville problem with two turning points. Generalized WKB method is applied for calculating partial amplitudes. Asymptotic properties of effective coupling constant are discussed.

**39595 (KFKI—1982-36) Quark model and high energy collisions.** Nyiri, J.; Anisovich, V.V.; Shabelski, Yu.M.; Kobrinsky, M.N. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jun 1982. 126p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83701681.

Portions are illegible in microfiche products28 refs.

The aim of the present review is to show that the additive quark model describes well not only the static features of hadrons but also the interaction processes at high energies. Considerations of the hadron-hadron and hadron-nucleus interactions and of the hadron production in multiparticle production processes suggest serious arguments in favour of the nucleus-like hadron structure and show the possibility to apply the rules of quark statistics to the description of the secondary particle production.

**39596 (KFKI—1982-38) Energy dependence of KNO moments using Novero-Predazzi's method with a new ansatz.** Krasznovszky, S.; Wagner, I. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jun 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701682.

Portions are illegible in microfiche products1 refs.; 4 figs.

The method of Novero-Predazzi is applied to a new ansatz with three constraints. Hadronic production cross-section σsub(n)(s) satisfying KNO-like constraints is determined. σsub(n)(s) and <n>Psub(n) automatically have KNO scaling property. The multiplicity distribution Psub(n) obtained is identical with the empirical formula used by Bozoki et al. The generalization of the method is investigated for more than three constraints. Assuming a given energy dependence of the parameter in the KNO function the authors have found that all calculated higher moments csub(k) of the KNO function were in excellent agreement with the observed values of csub(k)-s for pp interactions at Serpukhov, at FNAL and ISR energies.

**39597 (KFKI—1982-52) Radiative corrections of semileptonic hyperon decays Pt. 1. 'Weak' corrections.** Margaritisz, T.; Szegoe, K.; Toth, K. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jul 1982. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701683.

Portions are illegible in microfiche products3 refs.

The beta decay of free quarks is studied in the framework of the standard SU(2) x U(1) model of weak and electromagnetic interactions. The so-called 'weak' part of radiative corrections is evaluated to order α in one-loop approximation using a renormalization scheme, which adjusts the counter terms to the electric charge, and to the mass of the charged and neutral vector bosons, Msub(w) and Msub(o), respectively. The obtained result is, to a good approximation, equal with the 'weak' part of radiative corrections for the semileptonic decay of any hyperon. It is shown in the model that the methods, which work excellently in case of the 'weak' corrections, do not, in general, provide us with the dominant part of the 'photonic' corrections.

**39598 (KFTI—82-4) Amplitudes of the process $\gamma d \rightarrow \pi^0 d$.** Zayats, A.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702012.

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Considering deuteron as an elementary particle the covariant description of the $\gamma d \rightarrow \pi^0 d$ process is performed. Invariant amplitudes, amplitudes in c. i. s., helical and multipole amplitudes are introduced for consideration. Correlations between them are established. Multipole amplitudes disintegrations in c. i. s. are given. Contributions into the cross section and asymmetry of dibaryon resonances with spin and parity $0^+$, $1^{+-}$, $2^{+-}$, $3^{+-}$ are discussed in detail. Contribution into multipole asymmetry with a high moment value turns to be important.

**39599 (KFTI—82-6) Polarized Z boson production in eN and $e^+e^-$ collisions.** Stoletnij, I.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701976.

Portions are illegible in microfiche products5 refs.; 2 figs.

The article deals with investigation of the $e^+e^- \rightarrow e^+e^-Z$ processes and in the framework of parton model with investigation of the $eN \rightarrow eZx$ interaction in lower order by weak and electromagnetic interaction constants at energies essentially exceeding the Z boson production threshold in the case of low angles of electron scattering. It is shown that in this field the processes under consideration are described by Feynman similar diagrams. The density matrix of Z-boson formed in c. m. s. of initial positron (quark) and virtual photon is calculated as electron scattering angle function in a laboratory system and invariant values. Its dependence on initial electron polarization has been found. The formula expressing the said density matrix only through the invariant variables is given. Besides, the contribution of the above processes in structural functions is calculated.

**39600 (LA-UR—83-1397) Contributions of double-Δ and other two-nucleon mechanisms to pionic pion production on the deuteron.** Liu, L.C.; Bhalerao, R.S.; Piasetzky, E. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 8p. (CONF-830588—1). NTIS, PC A02/MF A01. Order Number DE83012666.

From Delta-Nucleus dynamics symposium; Argonne, IL, USA (2 May 1983).

In the deuteron, the simplest pion production mechanism is the quasifree process in which the pion is produced on a single nucleon, with the second nucleon acting as a spectator. More interesting mechanisms, however, are those in which both the nucleons are actively involved, as shown in Figs. 1b to 1d. In addition, there exist higher-order two-nucleon processes involving both πN and NN rescatterings. At T/sub π/ > 250 MeV, there is evidence that the basic production could proceed via intermediate πN- and ππ-resonances, including the Δ(1232) resonance. Considering the fact that the πN rescattering can also proceed through the formation of a Δ(1232), we then have a situation in which two Δ(1232) can be simultaneously present. Recently, G.E. Brown et al. have proposed a double-Δ model to explain certain features of pion absorption by nuclei. It seems useful to further examine this mechanism by use of other nuclear reactions, such as the $\pi^-d \rightarrow \pi^+\pi^-nn$ reaction. In this report, we only briefly describe our calculations of the quasifree process and π production followed by πN rescattering. We have also omitted the distortion of the incoming pion wave. This approximation should not affect our conclusion concerning the relative importance of the two diagrams studied. (WHK)

**39601 (RL—82-017) Decays of heavy quark systems: effects of gluon condensate.** Reinders, L.J.; Rubinstein, H.R.; Yazaki, S. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Feb 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701685.

The perturbative and nonperturbative contributions to three-point functions are computed to first order in αsub(S) and the results applied to the decay nsub(C)→2γ. Large corrections are found compared to the nonrelativistic result.

**39602 (RL—82-027) Theoretical approaches to charm hadroproduction.** Combridge, B.L. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Mar 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701977.

Some theoretical models for the hadronic production of charmed states are reviewed, with emphasis on problems encountered and questions raised by the various descriptions. The main topics discussed are the qq-bar → cc-bar and gg → cc-bar mechanisms, intrinsic charm, and charm 'excitation.

**39603 (RL—82-047) Meson resonances and glueballs: theoretical review and relevance to PP at LEAR.** Barnes, T. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). May 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701978.

Some theoretical ideas about the meson spectrum are reviewed and lessons which may be learned about it in PP-bar annihilation are considered. Experimental questions which, if answered, would have the largest impact on the present understanding of quark and gluon interactions are noted. Conventional qq-bar mesons as treated in potential models, concentrating on the familiar cc-bar systems, are reviewed. The exciting possibility is discussed of detecting constituent gluons in PP-bar annihilations, in gg states - which may already have been detected in $e^+e^-$ and PP-bar, as will be seen and in the exotic Jsup(PC) 'hermaphrodite' states qq-bar, for which there is currently no experimental evidence.

**39604 (RL—82-074) Slow rescaling variable for heavy quark leptoproduction.** Phillips, R.J.N. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Aug 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701979.

The customary slow rescaling variables give wrong threshold behaviour for leptoproduction structure functions in processes where a heavy initial quark is excited. From an evaluation of current-gluon fusion models, which contain many realistic features including correct heavy-quark kinematics, it appears that the variable $(Q^2 + (msub(i)+msub(f))^2)/(2msub(N)upsilon)$ gives greatly improved threshold behaviour and slow rescaling, where msub(i) and msub(f) are initial and final interacting quark masses. This variable therefore seems a more promising basis for parameterizing data. Charm muoproduction data appear to be consistent with scaling in this variable, after allowing for the vanishing of $W_2$ at $Q^2 = 0$.

**39605 (UWThPh—81-23) Baryon decay in grand unified theories.** Stremnitzer, H. (Vienna Univ. (Austria)). 1981. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701980.

The already reported events on proton decay in the Kolar-goldmine experiment give rise to the hope that the forthcoming big American experiments will provide us with more information in the next year. Some of the conventional models of grand unification can probably be ruled out. Further possible surprises are mentioned.

**39606 (UWThPh—81-28) Quark and diquark fragmentation into mesons and baryons.** Bartl, A.; Fraas, H.; Majerotto, W. (Vienna Univ. (Austria)). 1981. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701981.

Quark and diquark fragmentation into mesons and baryons is treated in a cascade-type model based on six coupled integral equations. An analytic solution including flavour dependence is found. Comparison with experimental data is given. Our results indicate a probability of about 50 percent for the diquark to break up.

**39607 (UWThPh—82-13) Comment on searches for excited leptons in $e^+ e^-$ - collisions.** Pietschmann, H.; Stremnitzer, H. (Vienna Univ. (Austria)). 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701982.

Recently, limits on mass or coupling constant on heavy excited leptons have been given by measurement of the $e^+ e^-$ final states. We would like to point out, that these limits can be substantially improved by the fact, that such excited leptons must contribute to the anomalous magnetic moments of electron and for muon, as already shown in an earlier paper.

**39608 (UWThPh—82-24) Simultaneous and systematic study of meson and baryon spectra in the quark model.** Ono, S.; Schoeberl, F. (Vienna Univ. (Austria)). 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701983.

We show the whole quarkonium spectrum is nicely reproduced by a single nonrelativistic q-q-bar potential Vsub(qq-bar) = V(scalar) + V(vector). The baryon spectrum can also be reproduced remarkably well if we use the same potential with slightly different weight Vsub(qq-bar) = 1/2 (V(scalar) + 3/2 V(vector)).

**39609 Hadronic PSIPSI events: Evidence for B-meson production.** Barger, V.; Halzen, F. (Wisconsin Univ., Madison (USA). Dept. of Physics); Keung, W.Y. (Brookhaven National Lab., Upton, NY (USA)). *Physics Letters, [Section] B;* **119**: No. 4-6, 453-455(Dec 1982).

Observed $\pi$N -> psipsiX events are ascribed to B-meson production followed by B -> psiX decays. The rate is consistent with that predicted by perturbative QCD. The characteristics of the dominant flavor excitation mechanism where the $\pi$-beam produces a leading B meson and a secondary anti B (or vice versa) are reflected in the longitudinal and transverse momentum distributions of the psi mesons and in a large psipsi invariant mass. The same kinematic features of the events disfavor production exclusively via charm quarks.

**39610 (DESY—82-053(Rev.Ext.Ed.)) Prediction of low-lying oddballs in lattice QCD.** Sato, A.; Schierholz, G.; Ishikawa, K.; Teper, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Oct 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750674.

We find, in a high precision Monte-Carlo calculation of the glueball mass spectrum in pure SU(3) lattice gauge theory, a low-lying odd-ball with quantum numbers $1^{-+}$. We estimate its mass to be $m(1^{-+})=1.68 +- .18$ GeV. We also measure the mass of the $0^{--}$ oddball and find $m(0^{--})=2.79 +- .22$ GeV.

## 6453 Particle Invariance Principles And Symmetries

*REFER ALSO TO CITATION(S) 39509, 39635, 39748*

**39611 (CEA-CONF—6421) Susskind fermions in configuration space.** Kluberg-Stern, H.; Morel, A.; Napoly, O.; Peterson, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1982. 10p. (CONF-820718—32). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701670.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

It is shown how to write the Susskind fermionic action in the Lagrangian formalism explicitly in terms of flavour Dirac fields defined on hypercubes in position space. The remnant continuous global symmetries may be identified with a U(1)sub(V) x U(1)sub(A) group, where the axial symmetry is flavour non-singlet. The formalism is applied to the calculation of the decay constant of the pseudoscalar Goldstone boson in the strong coupling limit, where we have previously shown that the U(1)sub(A) symmetry is spontaneously broken.

**39612 (DOE/ER/01545—334) Chiral-symmetry restoration in baryon-rich environments.** Kogut, J.; Matsuoka, H.; Stone, M.; Wyld, H.W.; Shenker, S.; Shigemitsu, J.; Sinclair, D.K. (Ohio State Univ., Columbus (USA). Dept. of Physics). Apr 1983. Contract AC02-76ER01545. 57p. NTIS, PC A04/MF A01. Order Number DE83012317.

Chiral symmetry restoration in an environment rich in baryons is studied by computer simulation methods in SU(2) and SU(3) gauge theories in the quenched approximation. The basic theory of symmetry restoration as a function of chemical potential is illustrated and the implementation of the ideas on a lattice is made explicit.

A simple mean field model is presented to guide one's expectations. The second order conjugate-gradient iterative method and the pseudo-fermion Monte Carlo procedure are convergent methods of calculating the fermion propagator in an environment rich in baryons. Computer simulations of SU(3) gauge theory show an abrupt chiral symmetry restoring transition and the critical chemical potential and induced baryon density are estimated crudely. A smoother transition is observed for the color group SU(2).

39613 **(IC—80/170) Unitary symmetries in Budini's theory of quarks.** Tarski, J. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1980. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701629.

Budini's approach to quarks, where the latter are described in terms of semispinors, is considered. The unitary symmetries are interpreted as groups of equivalence transformations of representations. Some connections with octonions are pointed out.

39614 **(IC—81/201) Supersymmetry breaking in a magnetic field.** Akyeampong, D.A. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701640.

The one-loop effective potential of an abelian supersymmetric model in an environment provided by a constant external magnetic field is derived. It is shown that magnetic field breaks supersymmetry and that the value of the resulting minimum potential is lower than that of the tree level. This could be relevant to the question of possible restoration of the symmetry at higher loops.

39615 **(IFVE-OTF—82-103) Spontaneous symmetry breaking by xisth order polynomials.** Klimenko, K.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701852.

In the theories with sixth order potentials by scalar fields spontaneous symmetry breaking by symmetric and antisymmetric multiplets of SU(n) and (N,n) representation of O(N)xO(n) group is studied. The investigation results can be used in models which presenet interest from the viewpoint of critical phenomena as in theories with these potentials different phase transitions at least at the classical level i.e. variation of invariant vacuum properties are possible.

39616 **(JINR—E-2-82-442) Supersymmetric quasipotential equations.** Zaikov, R.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701866.

From 21. International conference on high energy physics; Paris (France) (1982).

Supersymmetric generalization of the Logunov-Tavkhelidze quasipotential approach is supposed. As in the ordinary case, the starting point is the supersymmetric Bethe-Salpeter equation. Corresponding transition from the four-time Green function to the two-time one is done in the fixed reference frame in the superspace. The resolvent operator is find using the Majorani character of the two-fermionic wave function. The supersymmetric quasipotential equation is written down and the symmetry breaking terms are discussed.

39617 **(JINR-R—2-82-345) Group structure of the hidden symmetry transformations for the SU(N) Thirring model.** Zajkov, R.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701883.

The group structure of the hidden symmetry transformations, which generate the higher local conserved charges for the massless SU(N) Thirring model is investigated. A class of transformations which changes the Lagrangian of the model by the full derivative, for arbitrary fields, is found. It is shown that there exist the the transformations generators which form an infinite Lie algebra.

39618 **(RL—82-024) Grand unification with large supersymmetry breaking.** Ellis, J.; Ibanez, L.; Ross, G.G. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Mar 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701891.

General criteria are given for the magnitudes of mass splittings between supersymmetric partners compatible with the desired hierarchy of mass scales in GUTs. These splittings arise naturally when masses are generated radiatively from a Higgs sector breaking supersymmetry through the O'Raifeartaigh mechanism (Nucl. Phys; B96:331 (1975)). Explicit GUTs are constructed in which the supersymmetry breaking scale may easily be as large as the Planck mass.

## 6454 Field Theory

*REFER ALSO TO CITATION(S) 39611, 39612*

39619 **(DESY—82-082) Dirac-Kaehler fields and the lattice shape dependence of fermion flavour.** Goeckeler, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750671.

We investigate the Dirac-Kaehler operator on a triangular lattice in two dimensions and show that the number of degrees of freedom which survive in the continuum limit is the same as in the case of a square lattice.

39620 **(IC—80/89) Monopoles and twisted sigma models.** Akdeniz, K.G.; Goodman, M.; Percacci, R. (International Centre for Theoretical Physics, Trieste (Italy)). Jun 1980. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701632.

Using the fibre bundle formulation of gauge theories, we find topologically twisted solutions for a non-linear sigma model (or Higgs model) coupled to an SO(3) Yang-Mills field representing a Dirac monopole of arbitrary strength.

39621 **(IC—80/95) Dynamical mass generation in (Usub(L)(1) x Usub(R)(1))².** Salam, A.; Strathdee, J. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1980. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701633.

The mass matrix for a pair of fermions interacting through chiral gauge fields is computed by solving approximate Dyson-Schwinger equations.

39622 **(IC—80/112) Bjorken-Paschos relation in the unified gauge theory.** Oh, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Jul 1980. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701671.

We have examined in the unified gauge theory with the integrally-charged quark model the Bjorken-Paschos relation within the impulse approximation of the parton picture. We find that the relation is valid for the forward scattering region and provides a reliable way to test the charge assignment of the quarks and the gluons.

39623 **(IC—80/164) QCD sum rules for light mesons.** Narison, S. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1980. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701627.

Bounds on the leptonic widths of light mesons rho, $\omega$, phi, $A_1$, Ksup(*) are derived from the positivity and the analyticity of the spectral functions, within the framework of quantum chromodynamics (QCD). A comparison of the bounds with previous estimates and with experiment is done.

39624 **(IC—80/167) Renormalization and short distance properties of hadronic operators in QCD.** Craigie, N.S.; Dorn, H. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1980. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701628.

We discuss the renormalization of the contour dependent gauge invariant composite bilocal or string operator q-bar(2) exp 'g integ$_1^2$ A dz' q(1) in QCD, which one would naturally associate with the hadronic bound states. We then discuss the short distance expansion of this operator as the end points merge. We argue that some functional average over all possible paths between $x_1$ and $x_2$ may be the appropriate operator to describe the mesonic modes in QCD and that the short distance expansion may provide a valuable insight as to the nature of this functional average. Most of our considerations are for smooth contours, however we propose a simple way of treating on the same footing the additional divergences pointed out by Polyakov due to sharp bends in the contour. The latter confirms the conclusions reached for smooth contours.

39625 **(IC—81/173) Energy-spectrum against topological charge in a nonlinear model in three space-dimensions.** Kundu, A. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701637.

A nonlinear field model in three space-dimensions with nontrivial Hopf invariant is studied in an intermediate $S^3$-manifold. Energy-spectrum of the system for different values of topological charge is calculated numerically, which with fair accuracy coincides with $E_1$ n(n+1)/2 where n=topological charge.

39626 **(IC—81/177) Supersymmetric SU(11), the invisible axion, and proton decay.** Alwis, S.P. de; Kim, J.E. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1981. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701638.

We supersymmetrize the very attractive flavour unification model SU(11). As with other supersymmetric GUTs the gauge hierarchy problem is simplified, but we may also have observable (tausub(p) is approximately $10^{33}$ yrs) proton decay. The required split multiplets are obtained by making the adjoint take a particular direction. Supersymmetry is broken softly at the TeV scale. There is a unique U(1)sub(A) symmetry, and hence there are no true Nambu-Goldstone bosons. The U(1)sub(A) is broken at the GUT scale and there result an invisible axion and neutrino masses.

39627 **(IC—81/182) Regularization of the quantum field theory of charges and monopoles.** Panagiotakopoulos, C. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1981. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701639.

A gauge invariant regularization procedure for quantum field theories of electric and magnetic charges based on Zwanziger's local formulation is proposed. The bare regularized full Green's functions of gauge invariant operators are shown to be Lorentz invariant. This would have as a consequence the Lorentz invariance of the finite Green's functions that might result after any reasonable subtraction if such a subtraction can be found.

39628 **(IFVE-OTF—81-140) Infrared asymptotics of Green functions and gauge invariant effective Lagrangian in quantum chromodynamics.** Alekseev, A.I.; Arbuzov, B.A.; Baykov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701851.

The Schwinger-Dyson equations are used to find infrared asymptotics for quark and gluon propagators. Gluon propagator is shown to have the asymptotics D(k) approximately $1/(k^2)^2$ at $k^2 \to 0$ which is also in agreement with an existence of massive solution for quark propagator. The infrared asymptotics of the triple gluon vertex is in this case of quite a definite form. The results enable us to formulate gauge invariant Lagrangian, effective in infrared region, for quantum chromodynamics. Possible application of the results to the problem of dynamical quark masses generation is discussed.

39629 **(IFVE-OTF—82-45) Quantum-field treatment of two-dimensional generalized Toda lattice equations.** Leznov, A.N.; Fedoseev, I.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701856.

It is shown that the two-dimensional quantum field model described by generalized Toda lattice equations can be completely integrated. In this methods of perturbation series of standart quantum field theory are used. An explicit form of Heisenberg field operators as the functionals of asymptotic fields has been found.

39630 **(IFVE-OTF—82-111) Bogolyubov transformation in terms of creation and annihilation operators.** Timofeevskaya, O.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701853.

Realization of Bogolyubov transformation which singls out a classical constituent of a boson field, right in terms of creation and annihilation operators is considered. This allows one to extend the field of application of this method.

39631 **(ITEP—48(1982)) Limits of electrodynamics: paraphotons.** Okun, L.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701861.

The paper discusses the accuracy with which electromagnetic interaction is studied at large distances. Possible deviations from standard electrodynamics are investigated. The consideration is carried out in the framework of a model which contains two (para) photons, the mass of one of them being non-negligible.

39632 **(JINR—E-2-82-316) Spinor analysis of the Yang-Mills theory in the Minkowski space.** Pervushin, V.N.; Horejsi, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701863.

From 21. International conference on high energy physics; Paris (France) (1982).

Spinorial methods are applied to the solution of self-duality equations for Yang-Mills field and the Dirac equation with an external self-dual field in the Minkowski space. Gauge group SU(2) is considered. It is shown that in the spinorial formalism an analog of the Yang construction of self-dual fields emerges naturally. Solutions of the Dirac eqUation for massless fermion with an arbitrary isospin, interacting with an external self-dual or anti-self-dual field are obtained. The external field is chosen to be the Minkowskian analog of the EUclidean Hooft Ansatz. It is shown that for the isospin 1/2 and 1 the solutions of the Dirac equation may be expressed in terms of the solutions of d'Alembert equation. The solutions obtained may be employed in the approach to gauge theories proposed recently, which is based on an analogy with the superfluidity theory; in such an approach the self-dual solutions of the Yang-Mills equations represent the vacuum.

39633 **(JINR—E-2-82-427) Geometric meaning of the N=1 Yang-Mills prepotential.** Ivanov, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701864.

From 21. International conference on high energy physics; Paris (France) (1982).

A deep similarity between intrinsic superspace geometries of the N=1 Yang-Mills theory and minimal N=1 supergravity is established. The N=1 Yang-Mills prepotential is shown to take values in the coset Gsup(c)/G, Gsup(c) being the complexification of gauge group G.

**39634 (JINR—E-2-82-441) Group structure of some hidden symmetry transformations.** Zaikov, R.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701865.

From 21. International conference on high energy physics; Paris (France) (1982).

The question about the existence of some hidden symmetries for the classical two-dimensional Thirring models and for the supersymmetric chiral models is discussed. It is shown that the generators creating the higher local conserving charges, form an infinite-dimensional Lie algebra. The same is proved about the nonlocal generators for the supersymmetric chiral models.

**39635 (JINR-R—2-82-151) Differential identities and conservation laws in field theory.** Barbashov, B.M.; Leonovich, A.A.; Pestov, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701872.

A method for deriving the symmetric energy-momentum tensor is proposed, which uses the properties of covariant differentiation. By this method the symmetric energy-momentum tensor is obtained for theories with higher-order derivatives and the Einstein generalized tensor for gravitational Lagrangians with arbitrary dependence on the curvature tensor. The equivalence of the suggested method and the Hilbert variational method is proved. Generalization for the case of Riemann-Cartan geometry is considered.

**39636 (JINR-R—2-82-248) Dynamical structure factors and clusterization in a class of relativistic field theories.** Makhan'kov, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 15p. (In Russian). (CONF-8208120—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701878.

From International conference on solitons; Edinburgh, UK (1 Aug 1982).

The dynamic structure factors which are related to the bion-type excitations are investigatid in the framework of the Klein-Gordon equation. It is shown that at low temperatures the contribution to the bion-type excitations dominates the contribution to the central peak and also gives rise to the satellites centered at harmonics of the main bion frequency (combinational scattering). Both the mean frequency of bions and their average density are defined by the temperature of a system. A possibility is discussed to generalize the results to (2, 1)- and (3, 1)-dimensional models.

**39637 (JINR-R—2-82-337) Some new completely integrable models of self-consistent field.** Mel'nikov, V.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 26p. (In Russian). (CONF-820778—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701882.

From 5. international seminar on high energy physics and field theory; Protvino, USSR (12 Jul 1982).

A new class of nonlinear evolution equations integrable by the inverse problem method is considered. Among the equations of this class several models of self-consistent field are found, which are described by the Schroedinger eqUation and the nonlinear equation defining evolution in time of the Schroedinger equation potential.

**39638 (JINR-R—2-82-376) "Color" soliton stability.** Barashenkov, I.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701884.

In addition to soliton solutions of the nonlinear Schroedinger equation with U(n, 0) "color" symmetry under the vanishing boundary conditions solutions under the nonvanishing ones are found. The energetical Q-stability investigation for both of them is reduced to the eigenvalue problem for an auxiliary matrix operator. To examine its spectrum the presence of "color" zero modes (i. e. generated by the "color" symmetry) appears rather essential. The consideration carried out permits to draw a conclusion on the applicability of the Q-theorem. With its help the stability of solitons is proved under the vanishing boundary conditions with arbitrarily chosen parameter magnitudes. Instability of solutions which are constants at both infinities is also shown for any allowable initial values.

**39639 (JINR-R—5-82-246) Existence of positively-defined particle-like solution of the nonlinear differential equation for the $PSI^4$-$BPSI^6$ theory.** Amirkhanov, I.V.; Zhidkov, E.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701889.

An investigation of the nonlinear equation $d^2/dx^2[psi(x)]-(l(l+1)/x^2+1)psi(x)=-psi(x)[4(psi^2(x)/x^2)-3eta^2(psi^4(x)/x^4)]$, eta > 0 (1) for boundary conditions psi(0)=psi(infinity)=0 (2) is performed. The equation for zero value of parameter l was investigated by many authors before. Here arbitrary integer value of l is considered. By means of variational approach the existence of positively-defined particle-like solution of the boundary value problem is proved.

**39640 (KFKI—1982-74) Spacetime quantum hypothesis, the confinement phenomenon and a model for hadrons.** Banai, M. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701641.

Portions are illegible in microfiche products7 refs.

A spacetime quantum hypothesis leading to a confinement phenomenon is discussed. Then a hybrid model for hadrons is outlined. The hadron consisting of quarks moves in a Minkowski space $M^4$ and is described, as the whole object, by the usual relativistic quantum theory, while the quarks inside the hadron move in a quantum spacetime. Consequently, they are permanently confined inside the hadron. The mass spectra following from the model are also studied.

**39641 (UWThPh—81-20) Phase structure of lattice models with a SU(3) subgroup as gauge group.** Grosse, H.; Kuehnelt, H. (Vienna Univ. (Austria)). 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701893.

The phase structure of lattice gauge theories with nonabelian subgroups ($6n^2$)) of SU(3) as gauge groups is analyzed by Monte Carlo simulations. We discuss the dependence of the critical temperature on the number of space time dimensions using Wilson's action and remark that an alternative action recently proposed by Manton violates a positivity requirement.

**39642 (UWThPh—81-25) Remarks on alternative lattice actions and phase structure of lattice models.** Grosse, H. (Vienna Univ. (Austria)). 1981. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701894.

We state the requirements of lattice gauge theories, remark that Manton's action violates reflection positivity, mention the equivalence of $Z_4$ and $Z_6$ x $Z_6$ theories and discuss how well the SU(3) gauge theory is approximated by taking nonabelian subgroups as a gauge group.

**39643 Two-loop corrections to the beta function for the Higgs-Yukawa coupling constant.** Fischler, M. (Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy); Oliensis, J. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physics Letters,* [*Section*] *B;* 119: No. 4-6, 385-386(Dec 1982).

The complete second-order corrections to the $\beta$-function for the coupling gpsi anti psiPHI are calculated in the standard model, including Yukawa, strong and electroweak terms.

39644 **Gluon bremsstrahlung effects in hadron-hadron collisions.** Field, R.D. (Florida Univ., Gainesville (USA). Particle Theory Group); Fox, G.C. (California Inst. of Tech., Pasadena (USA)); Kelly, R.L. (Arete Associates, Encino, CA (USA); California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Physics Letters, [Section] B;* **119**: No. 4-6, 439-444(Dec 1982).

We show that the inclusion of noncolinear gluon bremsstrahlung is essential in a quantum-chromodynamic (QCD) description of large transverse energy events in hadron-hadron collisions. Recent data from CERN and Fermilab for both large and small aperture energy triggers give indirect experimental support for QCD and for gluon bremsstrahlung effects.

## 6455 Scattering Theory

*REFER ALSO TO CITATION(S) 39622*

39645 **(IC—81/136) Analyses of the energy-dependent single separable potential models for the NN scattering.** Ahmad, S.S.; Beghi, L. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1981. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701634.

Starting from a systematic study of the salient features regarding the quantum-mechanical two-particle scattering off an energy-dependent (ED) single separable potential and its connection with the rank-2 energy-independent (EI) separable potential in the T-(K-) amplitude formulation, the present status of the ED single separable potential models due to Tabakin (M1), Garcilazo (M2) and Ahmad (M3) has been discussed. It turned out that the incorporation of a self-consistent optimization procedure improves considerably the results of the $^1S_0$ and $^3S_1$ scattering phase shifts for the models (M2) and (M3) up to the CM wave number $q=2.5$ fm$^{-1}$, although the extrapolation of the results up to $q=10$ fm$^{-1}$ reveals that the two models follow the typical behaviour of the well-known super-soft core potentials. It has been found that a variant of (M3) - i.e. (M4) involving one more parameter - gives the phase shifts results which are generally in excellent agreement with the data up to $q=2.5$ fm$^{-1}$ and the extrapolation of the results for the $^1S_0$ case in the higher wave number range not only follows the corresponding data qualitatively but also reflects a behaviour similar to the Reid soft core and Hamada-Johnston potentials together with a good agreement with the recent [4/3] Pade fits. A brief discussion regarding the features resulting from the variations in the ED parts of all the four models under consideration and their correlations with the inverse scattering theory methodology concludes the paper.

39646 **(JINR-R—2-82-114) T-channel helicity amplitudes and dispersion inequalities.** Chavlejshvili, M.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701870.

A new method is proposed for deriving the model independent dispersion restrictions rules on differential cross section for the Compton effect on the arbitrary spin target based on the use of t-channel helicity amplitudes. The simplicity of this formalism is shown that is valid for any binary reaction. In such an approach basic conditions are fulfilled which are required for the formalism when deriving dispersion inequalities: the differential cross section is expressed in terms of modulus of amplitudes from which the kinematic singularities in variable $\nu$ are separated out.

39647 **(JINR-R—2-82-129) Several new nonlinear evolution equations solvable by the inverse problem method.** Mel'nikov, V.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701871.

Several new nonlinear evolution equations solvable by the method of inverse problem are found. To a great extent the method used for finding these equations is new.

39648 **(JINR-R—2-82-157) One-dimensional relativistic motion of two bodies with interaction force constant in modulus.** Shavokhina, N.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701874.

The relativistic linear motion of two bodies is considered with the interaction force which is modulo constant. Inelastic and elastic collisions of these bodies are studied. In exact mathematical model of the relativistic oscillator is constructed.

39649 **(JINR-R—2-82-163) Covariant two-particle wave functions for model quasipotential allowing exact solutions. Solutions in the relativistic configurational representation.** Kapshaj, V.N.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701875.

Two formulations of quasipotential equations in the relativistic configurational representation are considered for the wave function of relative motion of a bound state of two relativistic particles. Exact solutions of these equations are found for some model quasipotentials.

39650 **(JINR-R—2-82-185) Quasipotential Coulomb scattering of scalar particles.** Gogokhiya, V.Sh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701876.

Quasipotential scattering model of scalar particles of equal masses and for quasipotential having in coordinate representation the Coulomb form is considered. In this case integral quasipotential equation for partial amplitudes is reduced to the Sturm-Liouville problem with two transition points. The comparison equation method (CEM) in the suitable form for two transition points (or more) of initial equation is applied for calculating partial amplitudes. Asymptotic properties of effective coupling constant are discussed.

39651 **(JINR-R—2-82-272) Exact solutions of the quasipotential equations for the Coulomb and linear confining potentials.** Kapshaj, V.N.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701879.

Covariant two-particle equations are considered for the quasipotentials that are relativistic generalizations of known potentials of quantum mechanics. Exact solutions are found for the three-dimensional nonlocal Logunov-Tavkhelidze equation for the case of Coulomb interaction and for the local equation in the case of the confining quasipotentiai (at is a tinear quasipotential in the relativistic configurational representation). One-dimensional quasipotential equations are also considered.

39652 **(JINR-R—5-82-239) Wahlquist-Estabrook method for the investigation of nonlinear evolution equations. One-dimensional case.** Shwachka, A.B.; Yanovski, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701887.

The Wahlquist-Estabrook method which yields the inverse scattering method equations is considered. A short review is presented on the interpretation of the prolongation forms as connection forms and also on a possible extension of the method for the case of two spatial dimensions. For the description of the generalized Ablowitz-Kaup-Newell-Segur system a connection with structural group GLsub(n+1, R) is proposed.

**39653 (JINR-R—5-82-242) Wahlquist-Estabrook method for the investigation of nonlinear evolution equations. Two-dimensional case.** Shvachka, A.B.; Yanovski, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701888.

The Wahlquist-Estabrook method which yields the linear "inverse scattering" equations for a given system of the nonlinear evolution equations is considered. A short review is presented on the interpretation of prolongation forms as connection forms and also on a possible extension of the method for the case of two spatial dimensions. It is assumed that the second space variable enters the evolution equation in a special way so that the equation does not contains derivatives higher than the first one over this variable.

# 65 PHYSICS RESEARCH

## 6510 Nuclear Physics

*REFER ALSO TO CITATION(S) 38575, 38930*

**39654 (AECL—7073) AECL programs in basic physics research.** Bartholomew, G.A.; Dolling, G.; Harvey, M.; Milton, J.C.D. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Feb 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701623.

This report describes the CRNL program of research into the basic properties of atomic nuclei and condensed matter (liquids and solids). Brief descriptions are given of some of the current experimental programs done principally at the NRU reactor and MP tandem accelerator, the associated theoretical studies, and some highlights of past achievements.

**39655 (JAERI-M—83-041) Proceedings of the 1982 seminar on nuclear data.** Murata, T.; Asami, T.; Igarasi, S.; Mizumoto, M. (eds.). (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Japanese Nuclear Data Committee). Mar 1983. 244p. (In English and Japanese). (NEANDC(J)—90/AU; INDC(JAP)—77/G; CONF-821193—). Japan Atomic Energy Research Inst., Division of Technical Information, Tokai-mura, NaKa-gun, Ibaraki-Ken, Japan.

From JAERI seminar on nuclear data; Tokai, Japan (24 Nov 1982).

The 1982 Seminar on Nuclear Data was held on November 24 and 25, 1982 in Tokai Research Establishment of JAERI, by Japanese Nuclear Data Committee (JNDC). The proceedings contain the texts of the commemorative talk for the 20th anniversary of JNDC, the review talks on the nuclear data activity in JNDC, the topical discussion, and the panel discussion by users, evaluators and experimenters. Topics covered include: the theory of preequilibrium process, a new statistical method and the sensitivity analysis for FBR; the nuclear data needs for FBR burn-up calculation, and for fusion integral experiment; status of JENDL-3. Given are the papers presented and the discussion made at the seminar.

## 6511 Experimental Techniques

**39656 (JINR-R—15-82-92) Study on the nuclear structure by means of laser radiation.** Oganesyan, Yu.Ts.; Gangrskij, Yu.P.; Markov, B.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 8p. (In Russian). (CONF-8106275—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702027.

From 2. All-union school on application of lasers in atomic, molecular and nuclear physics; Vil'nyus, USSR (29 Jun 1981).

Some methods of application of tunable dye lasers for determining dimensions and shapes of radioactive nuclei both in the ground and in isomeric states, for instance, in the case of spontaneously fissioning isomers are described. It will be emphasized that laser radiation could be used for orientation of nuclei, by its means one could affect rates of nuclear processes and detect single atoms.

## 6512 Nuclear Properties And Reactions, A=1-5

**39657** (INDC(CCP)—177/L, pp 27-30) **Energy dependence of the total cross-section for interaction between neutrons and $^3$He nuclei in the range 0.025-250 eV.** Alfimenkov, V.P.; Borzakov, S.B.; Vezhbitski, Ya.; Govorov, A.M.; Pikel'ner, L.B.; Sharapov, Eh.I. May 1982. NTIS (US Sales Only), PC A04/MF A01.

Translated from Russian.

In Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).

The authors of this paper report measurements of the total cross-section for interaction between neutrons and $^3$He nuclei in the energy range 0.025-250 eV.

**39658 (ITEF—32(1982)) Separable NN interaction and nucleon-deuteron scattering at the Esub(L) <= 100 MeV energies.** Veselov, A.I.; Grach, I.L.; Narodetskij, I.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 28p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701998.

Microfiche only, copy does not permit paper copy reproduction2 refs.; 4 figs.; 3 tabs.

The half-shell and on-shell partial wave amplitudes for elastic nucleon-deuteron scattering are calculated numerically for the Amado model at nucleon laboratory energies Esub(L) <= 100 MeV. The Adhikari-Sloan method and its generalization for two-channel nucleon-deuteron scattering are used. On-shell amplitudes are given in a tabulated form. Plots of the half-shell amplitudes at 2.59 and 14.1 MeV are presented. It is shown that in the energy range higher threshold of deuteron break up proximity of logarithmic peculiarity leads to strong dependence of half-shell amplitudes near energy surface. The results will be used in a subsequent paper for calculating the effect in the reaction tp → pid at psub(t)=2.5 GeV/c.

## 6513 Nuclear Properties And Reactions, A=6-19

*REFER ALSO TO CITATION(S) 38930, 39685*

**39659** (IAEA-TECDOC—263, pp 89-92) **Nuclear data needs and standard spectra for the measurements and analyses of D-Li neutron spectra.** Dierckx, R. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Cesana, A.; Terrani, M.; Sangiust, V. (Politecnico di Milano (Italy)). Apr 1982. NTIS (US Sales Only), PC A15/MF A01. (CONF-811070—).

From IAEA advisory group meeting on nuclear data for radiation damage and safety; Vienna, Austria (12 Oct 1981).

An experiment is in preparation to set up two standard spectra for D-Li neutron source dosimetry. These spectra are produced by 50 MeV $D^+$ falling on a thick Li target and the spectra emitted under $0^0$ and $20^0$ will be taken. These spectra will be measured by T.O.F. techniques and activation detectors will be irradiated at the same position of the T.O.F. detectors for calibration. With calibrated detectors, spectra in the vicinity of target will be measured. A detector set is proposed and preliminary calculations are executed to find out which nuclear data are needed and in which energy region, to be able to analyze the measured reaction rates. The needed improvement of these data is discussed; after the execution of the measurements data needs and improvements will be revised.

**39660 (JINR—1-82-174) Alpha particle scattering at 17.9 GeV/c on carbon, aluminium and copper nuclei.** Ableev, V.G.; Bodyagin, V.A.; Vorob'ev, G.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701934.

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For the first time differential cross sections of summarized elastic and quasi-elastic α particle scattering at 17.9 GeV/c on $^{12}$C, $^{27}$Al, sup(63.5)Cu nuclei in the region of momentum transfers 0.009 < or approximately 't'< or approximately 0.175 (GeV/c)$^2$ with

systematic normalization error not more than 3% are measured. It is shown that data obtained on different nuclei are convenient for comparison in "geometric scaling" variables. The comparison of the results obtained with the Glauber-Sitenko diffractional multiple scattering theory (DMST) calculations is fulfilled. The best agreement with the experiment is attained in the "cluster" model for $\alpha$ particle. It follows from calculations that the quasi-elastic scattering relative contribution is not great in the diffraction cone region but after the 1-st minimum it becomes noticeable. The analysis of behaviour of relations of calculated differential cross sections with the measured ones shows that the value and behaviour of these relations depending on time is independent of atomic number of the nucleus-target within the experimental arror limits, the divergence between the calculation and experiment reaches tens percent in the diffraction minimum vicinity.

**39661 (JINR—E-4-82-586) Meson-exchange corrections to the nuclear weak axial charge density in the hard pion model.** Kirchbach, M.; Truhlik, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702000.

Portions are illegible in microfiche products7 refs.; 1 fig.; 1 tab.

Meson-exchange corrections to the time component of the weak axial current operator are considered. The heavy meson exchange effect on the relation of partial velocities of transition in muon capture reactions into the ground state $^{16}O$ ($O^+$) with transition into the excited state $^{16}N$ ($O^-$; 120 keV) and reverse beta decay is elucidated. The diagrams with the heavy rho and $A_1$ meson exchange are considered in a formulated in the phenomenological Lagrangian language hard pion model. In the simple representation of the $O^+$ state structure as a closed 1psub(1/2)-shell and $O^-$ state as particle-hole configuration (2ssub(1/2) 1psub(1/2)sup(-1))sub(T=1)sup(J=0) the renormalization of the single-particle matrix element (2ssub(1/2)-1psub(1/2)) is calculated at the expense of exchange effects. It is somewhat less as compared with the one obtained in the absence of these charts. The transition velocity relation is changed towards the experiment side. Heavy meson exchange account does not lead to reduction of exchange current role in the problem under consideration.

**39662 (JINR—R-4-82-257) Strength functions for EL-excitations in $^{16}O$ nucleus.** Pal'chik, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702007.

Portions are illegible in microfiche products5 refs.; 1 fig.; 1 tab.

The distributions of particle-hole El-transitions in $^{16}O$ in the 0-60 MeV energy range are studied in the framework of the self-consistent model taking into account the one-particle continuum. The separable effective interactions are constructed from the shell model potential using the consistency condition which follows from the translational invariance. Systematic calculations of radiative strength functions for L=1-4 are performed. The location of resonances and their escape widths are determined. Isotopic structure of the distributions is studied and the energy-weighted sum rules are calculated. The results obtained are compared both with experimental data and other theoretical calculations. It is shown that the simple self-consistent model employed in the present work describes the qualitative characteristics of observed distributions as well as other models with the more sophisticated effective interactions.

**39663 (KIYI—81-22) Elastic and inelastic scattering of 50 MeV protons by $^{12}C$.** Aleshin, V.A.; Aushev, V.E.; Zaika, N.F. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702034.

An apparatus installed on U-240 accelerator to investigate the differential cross sections and polarization is described. Schematic diagrams of equipment accomodation, beam collimation, scattering chambers spectrometers, handling and control systems, system to pile up information are presented as well as measurements of the elastic and inelastic scattering of 50 MeV protons incident on $^{12}C$. The differential cross sections of $0^+$, $2^+$(4.44 MeV), $0^+$(7.65 MeV) and $3^-$(9.64 MeV) $^{12}C$ levels are compared with predictions of the coupled channel approximation with the vibrational wave functions.

**39664 Coulomb dissociation in relativistic heavy ion reactions.** Mercier, M.T. Ames, IA; Iowa State Univ. (1982). 93p. University Microfilms Order No. 82-24,235.

Thesis (Ph. D.).

Targets of $^{12}C$, $^{59}Co$, $^{89}Y$, $^{197}Au$ and $^{238}U$ were bombarded by 2.1 GeV/A $^1H$, $^{12}C$ and $^{20}Ne$ projectiles using the SuperHILAC and BEVATRON facilities at Lawrence Berkeley Laboratory (LBL). The beam flux was calculated by monitoring the decay of $^{11}C$ produced from the $^{12}C$(projectile,projectile n)$^{11}C$ reaction. Residual gamma-ray activity from the Co, Y, Au and U targets was collected in order to trace the decay of several reaction products. The experiment focused on the calculation of cross sections for the formation of products with one neutron removed from the various target nuclei. Corrections to the saturation activity of each product were made for detector efficiency, gamma-ray absorption in the target, gamma-ray branching, beam geometry and secondary reactions. These date are shown to be inconsistent with a geometrical form given by $\sigma$ varies as (A/sub p/sup 1/3/ + A/sub t/sup 1/3/ - b) where b is a universal constant. In fact the data indicates the b = A/sub t/sup 1/3/. Instead the data can be fit quite well by a simple empirical relation, $\sigma$/sub emp/ = 12.0 mb A/sub p/sup 1/3/ A/sub t/sup 1/3/. It is demonstrated that an empirical fit which varies as A/sub t/sup 1/3/ is also consistent with projectile fragmentation data measured by a group at LBL. In addition these data are compared to a theoretical prediction which is the sum of a renormalized Glauber term and a term which represents the contribution due to Coulomb or electromagnetic dissociation (ED). The theoretical predictions are quite low for the $^{12}C$ projectile data and high for the $^{20}Ne$ projectile data. The systematic trends from the comparison seem to indicate that theoretical prediction for the ED contribution is rising too fast as a function of projectile for a given target.

## 6514 Nuclear Properties And Reactions, A=20-38

*REFER ALSO TO CITATION(S) 39660, 39684, 39685*

**39665 (CEA-CONF—6452) Nuclear deformation of the s-d shell nuclei by means of fast neutron scattering.** Haouat, G.; Lagrange, C.; Patin, Y.; Swiniarski, R. de; Dietrich, F.; Virdis, A. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Sep 1982. 4p. (In French). (CONF-820942—27). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702018.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

Nuclear deformation of $^{24}Mg$, $^{28}Si$ and $^{32}S$ has been investigated by means of fast neutron scattering. These nuclei lie in a mass region of the s-d shell where nuclear shape changes very rapidly from one nucleus to the other. Differential cross sections were measured at 9.76 and 14.83 MeV incident neutron energies over the angular range from 15 to 160 deg. Angular distributions were obtained for the elastic scattering and the inelastic scattering to levels of up to 6 MeV excitation energy. An analysis of the data using the deformed and the statistical models is presented and discussed. Quadrupole and hexadecapole deformations of the nuclear potential, deduced from the analysis of the $0^+$, $2^+$, $4^+$ states of the ground state rotational band, are compared to those obtained by other excitation processes.

**39666 (IAE—3460/2) Evaluation of repulsive core parameters in heavy ion interactions from an analysis of the $^6Li+^{28}Si$ elastic scattering.** Bragin, V.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 35p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702021.

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An attempt has been made to evaluate short-range repulsive core parameters in the potential of $^{6}$Li and $^{28}$Si nuclei interaction. The required data are obtained as a result of simultaneous analysis of experimental angular distributions of $^{6}$Li+$^{28}$Si elastic scattering at the collision energy Esub(Li)=30 and 154 MeV. The evaluation calculations for Esub(Li)=5.8-154 MeV are performed. The relation of the repulsive core with the equation of nuclear matter state is discussed. From the analysis of experimental data on elastic scattering of $^{6}$Li+$^{28}$Si at Esub(Li)=30 and 154 MeV an optical potential describing elastic scattering 30 MeV of $^{6}$Li+$^{28}$Si in a wide angle range THETA <= 172 deg is obtained. The most specific peculiarity of the potential obtained is the presence of strong repulsion at short distances (r <= 3.5 f) between nuclei mass centres. It is shown that the parameters of the repulsive core obtained can be roughly evaluated using the equations of state of nuclear matter while the depth of the potential real part (approximately 30 MeV) is in qualitative agreement with some other approaches in which ion-ion interaction is calculated theoretically.

39667 (INIS-SU—145, pp 261-266) **Possibility of the investigation of interaction between excited nuclei and nuclei using monocrystal targets.** Karamyan, S.A. 1980. (In Russian). NTIS (US Sales Only), PC AXX/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

The paper deals with consideration of possibility of obtaining data on interaction of excited atoms in the experiment with a monocrystal target on a beam of heavy ions. Some potentialities of extending the range of measurable life time of excited nuclear states using the shadow effect are also considered. Interaction of 1500 MeV $^{197}$Au ions with $^{27}$Al monocrystal is chosen for numerical evaluations.

39668 (INIS-SU—145, pp 290-295) **Effect of the $^{27}$Al(p, $\alpha$)$^{24}$Mg nuclear reaction depth in a monocrystal target on the alpha particle angular distribution shape in the <100> axis neighbourhood.** Eremin, N.V.; Melikov, Yu.V.; Syutkina, L.N.; Tulinov, A.F.; Chechenin, N.C.; Yuminov, O.A. 1980. (In Russian). NTIS (US Sales Only), PC AXX/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

The resonance $^{27}$Al(p, $\alpha$)$^{24}$Mg raction with excitation of $^{28}$Si* nucleus state 12.194 MeV at Esub(r)=633 keV and 12.489 MeV at Esub(r)=937 keV is used for experimental test of transition ratios connecting the shadow parameter changes observed in the experiment with the value of the average displacement of the compound nucleus from the crystal lattice point during its life time. Shadow profiles for different depths of the nuclear reaction occurrence corresponding to the experimental conditions are calculated by means of the Focker-Planck equation, the transition ratios obtained on this base are compared with the experimental dependences of different shadow parameters on the displacement value of the compound nucleus relatively to the crystallographic axis.

39669 (INIS-SU—145, pp 302-308) **Calculation of angular distribution of particles - nuclear reaction products in a monocrystalline target with the help of the kinetic Fokker-Planck equation.** Eremin, N.V.; Melikov, Yu.V.; Tulinov, A.F. 1980. (In Russian). NTIS (US Sales Only), PC AXX/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

Angular distributions of 2 MeV $\alpha$-particles from the $^{27}$Al(p, $\alpha$)$^{24}$Mg raction for 0 to 3 $\mu$m thick crystal layer transversed by the particles were calculated by the kinetic equation. The defect spatial distribution in the crystal was determined from the experimental data on the dependence of yields in the intensity minimum of 1 MeV protons scattered in the direction of the crystallographical axis <110> of Al monocrystal on the radiation dose. It is shown, first-of-all, that shadow profile calculations for essential thicknesses of the crystal layer which particles pass through should be conducted with account of the crystal-target structure quality. Secondly, the applied methods for accountancy of the effect of defects and change of the particle total energy with depth roughly reflect the experimental conditions.

39670 (KIYI—81-7) **Evaluated cross sections and resonance integrals for isotopes of elements with Z=11-16.** Pisanko, Zh.I.; Fedorova, A.F. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1981. 25p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702015.

74 refs.; 3 tabs.

The estimated values of neutron cross sections for neutron velocity Vsub(n)=2200 m/sec and resonance intergrals for isotopes of the elements with Z=11+16 are given.

39671 (KIYI—81-23) **Study on 6.9 MeV proton spin-flip in the inelastic scattering by nuclei at range A=24-58.** Prokopenko, V.S.; Sklyarenko, V.D.; Chernievskij, V.K.; Shustov, A.V.; Korbetskij, E.V. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1981. 30p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83702035.

Experimental data are given for the differential cross sections of the elastic and inelastic scattering and spin-flip probability at the inelastic scattering of protons with 6.9 MeV energy on sup(24, 26)Mg, sup(28, 30)Si, sup(32, 34)S, sup(46, 48, 50)Ti, sup(50, 52, 54)Cr and sup(54, 56, 58)Fe nuclei. The obtained results are analysed in the coupled channel method. The probable mechanisms of the nuclear reaction kinetic at the given energy are discussed.

39672 (LA-UR—83-1384) **Half life of $^{26}$Al.** Norris, T.L.; Gancarz, A.J.; Rokop, D.J.; Thomas, K.W. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 9p. (CONF-830359—1). NTIS, PC A02/MF A01. Order Number DE83012672.

From 14. lunar and planetary science conference; Houston, TX, USA (1 Mar 1983).

The half-life of $^{26}$Al has been redetermined because of suggestions of an error in the accepted value based on its use in calculating $^{21}$Ne production rates from cosmic rays in meteorites. Two solutions of $^{26}$Al were analyzed for the specific radioactivity and mass spectrometric determination of the $^{26}$Al concentration. The half-life obtained for $^{26}$Al was 7.05 x $10^{5}$ years +- 3.7% at the two sigma level. This is identical to the accepted value of 7.16 x $10^{5}$ years and indicates that problems with the $^{21}$Ne production rate is not due to an erroneous half-life.

## 6515 Nuclear Properties And Reactions, A=39-58

*REFER ALSO TO CITATION(S) 39671*

39673 (JINR—R-4-82-85) **High multipolarity nuclear excitations in a continuum.** Pal'chik, V.V.; Pyatov, N.I.; Fayans, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702010.

7 refs.; 2 figs.; 1 tab.; submitted to the journal Z. Phys., A.

The strength distributions of particle-hole isoscalar transitions with high multipolarities are considered in the framework of the independent particle model using the Woods-Saxon potential. It is shown that for the multipole operators jsub(L)(qr)Ysub(LM) with L >> Asup(1/3) and q <= psub(F)the distributions are peaked at the relatively low energy for all L, and their widths decrease as Lsup(-1/2). In contrast to that, for the surface external fields (thetaU/thetar)Ysub(LM) the centroid excitation energy is proportional to $L^{2}$ and the distribution widths increase as Lsup(4/3). The conclusion is drawn that the p-h excitations might be responsible for the structures in the excitation function obeserved in heavy ion collisions in the energy range up to approximately 2epsilonsub(F).

**39674** **(Juel—1797) Study of the particle decay of continuum states by means of the $^{58}$Ni(α,α'p) reaction at Esub(α)=140 MeV.** Bechstedt, U. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Bonn Univ. (Germany, F.R.)). Aug 1982. 111p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83750680.

Spectra of coincident protons and α-particles from the reaction $^{58}$Ni(α,α'c) at an incident energy of 140 MeV were measured for eight angles relativ to the fixed scattering angle of the α'-particles. Angular distributions of cross sections for coincident proton emission were deduced from proton spectra coincident to four bins of excitation energy. Angular distributions of differential particle multiplicities were calculated for protons and α-particles coincident to three bins of excitation energy. The differential multiplicities for α-particles are up to one order of magnitude smaller than that for protons. Nuclear temperatures were deduced from the proton spectra coincident to four bins of excitation energy. The angular dependence of these temperatures provides evidence for a local excitation of the target nucleus.

## 6516 Nuclear Properties And Reactions, A=59-89

*REFER ALSO TO CITATION(S) 39660, 39664*

**39675** **(INFN/BE—82/2) Deformation effect in the fast neutron total cross section of aligned $^{59}$Co.** Fasoli, U.; Pavan, P.; Toniolo, D.; Zago, G.; Zannoni, R.; Galeazzi, G. (Istituto Nazionale di Fisica Nucleare, Padua (Italy)). 19 Jul 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83902399.

The variation of the total neutron cross section, Δ σ/sub align/, on $^{59}$Co due to nuclear alignment of the target in the beam direction, has been measured over the energy range from 0.8 to 20 MeV, employing a cobalt single-crystal with a 34% nuclear alignment degree. The results show that Δ σ/sub align/ oscillates from a minimum of -5% at about 2.5 MeV to a maximum of +1% at about 10 MeV. The data were successfully fitted by optical model coupled-channel calculations. The coupling terms were deduced from a model representing the $^{59}$Co nucleus as a virbrational $^{60}$Ni core coupled to a proton-hole in a (lf 7/2) shell, without free parameters. The optical model parameters were determined by fitting the total cross-section independently measured. The theoretical calculations show that, at lower energies, Δ σ/sub align/ depends appreciably on the coupling with the low-lying levels.

## 6517 Nuclear Properties And Reactions, A=90-149

*REFER ALSO TO CITATION(S) 38930, 39092*

**39676** (INDC(CCP)—177/L, pp 7-12) **Investigation of averaged cross-sections for (n,α) reactions involving $^{123}$Te, $^{143}$Nd, $^{147}$Sm and $^{149}$Sm nuclei.** Andzheevski, Yu.; Vo Kim Tkhan'; Vtyurin, V.A.; Korejvo, A.; Popov, Yu.P.; Stehmpin'ski, M. May 1982. NTIS (US Sales Only), PC A04/MF A01.

Translated from Russian.

In Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).

The research on (n,α) reaction cross-sections averaged over resonances, which was recently started in the Neutron Physics Laboratory of the Joint Institute for Nuclear Research, has made it possible substantially to broaden the neutron energy range in comparison with earlier work on the (n,α) reaction in various resonances. Averaging over a large number of resonances enables us to improve the accuracy with which mean α-widths are determined and to study their dependence on neutron energy. The authors of the present paper have tested the following methods of measuring averaged cross-sections for the (n,α) reaction: use of the $^{7}$Li(p,n)$^{7}$Be reaction as a neutron source; use of filtered beams from a stationary reactor; time-of-flight method. The third method yields the most information, as it allows measurements to be made simultaneously in a continuous sequence of ranges, which leads to a smaller error in the determination of the relative behaviour of the cross-section and makes it possible to find its local changes, due, for instance, to the occurrence of α-cluster states in the compound nucleus.

**39677** (INDC(CCP)—177/L, pp 13-20) **Study of the fluctuations in cross-sections and total α-widths in the $^{147}$Sm(n,α)$^{144}$Nd and $^{67}$Zn(n,α)$^{64}$Ni.** Antonov, A.; Bogdzel', A.A.; Gledenov, Yu.M.; Marinova, S.; Popov, Yu.P.; Tishin, V.G. May 1982. NTIS (US Sales Only), PC A04/MF A01.

Translated from Russian. Published in summary form only.

In Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).

**39678** (INIS-SU—146, pp 3-21) **Correlation effects in fermion systems.** Zalyubovskij, I.I.; Kulagin, N.A. 1980. (In Russian). NTIS (US Sales Only), PC AXX/MF A01.

In Problems of nuclear physics and cosmic rays. No. 13. Republican interdepartmental scientific collection.

Methods of account of correlations in fermion systems: expanded method of calculation, method of configuration superposition and method of effective figures of filling up are reviewed. A large number of concrete results on account of correlations during investigation of energy schemes of electron system levels are presented at the example of ions with 4F shell being under the process of formation.

**39679** **(JINR—R-3-82-309) Extrapolation of the giant dipole electric resonance in a low-energy range.** Vtyurin, V.A.; Popov, Yu.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702005.

Microfiche only, copy does not permit paper copy reproduction5 refs.; 2 figs.; 1 tab.

The energy dependence of the strength function for E1 transitions was obtained in the energy interval 0.2 < Esub(γ) < 1.6 MeV using the experimental spectra of (nγα) reaction and the earlier derived relationship of averaged over this interval values of radiation strength functions of E1 and M1 transitions. A comparison was drawn of these data, data on hard γ-transitions and on photonuclear reaction on $^{124}$Te and $^{144}$Nd nuclei in the energy range from 0.2 to 20 MeV with several theoretical versions for the shape of the giant electric dipole resonance (GEDR). It was shown that neither the Lorentz nor Breit-Wigner shape of GEDR agreed with experimental data. At Esub(γ) << Esub(g) the value and shape of the dependence of the strength function on energy can be described, provided the properties of the polarization operator and dependence of the resonance width on nuclear temperature of the final state are taken into account correctly.

**39680** **(JINR—R-4-82-30) Interaction effect in the particle-particle channel on high-lying excited states.** Nguen Din' Tkhao; Stoyanov, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702008.

Portions are illegible in microfiche products9 refs.; 2 figs.; submitted to the journal Acad. Sci. USSR, Phys. Ser.

The influence of interaction in the particle-particle channel on the high-lying excited states of spherical nuclei is investigated. The investigations are performed in the random phase approximation. Numerical calculations are made for $2^{+}$ states of sup(144-150)Sm isotopes. The interaction influences on the integral properties of collective states weakly. It changes the structure of some non-collective states of semimagic nuclei. This effect can be observed in the (p, t) reaction cross section.

**39681** **(JINR—R-7-82-29) Probability of delayed fission of neutron-deficient nuclei.** Kuznetsov, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702011.

Portions are illegible in microfiche products1 refs.; 3 figs.; 1 tab.; submitted to the journal Voprosy Atomnoj Nauki i Tekhniki, seriya Yadernye konstanty.

The probabilities of delayed fission of neutron-deficient nuclei in the Z=94-101 range are calculated. It is shown that the P probability of delayed fission per one decay of initial nucleus has a maximum in the range of N=120-125 and N=132-136 for initial odd-odd nuclei and nuclei with odd mass. Some heavy ion reactions resulting in the production of neutron-deficient delayed emitters with N < 126 are given.

**39682 (JINR-R—3-82-305) Radiation strength functions of primary soft γ-transitions and total radiation widths.** Vtyurin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702004.

Microfiche only, copy does not permit paper copy reproduction5 refs.; 1 tab.

Estimates are drawn for the total radiative widths of $^{123}$Te, $^{143}$Nd, $^{147}$Sm and $^{149}$Sm on the basis of experimental values of the strength functions of γ-transitions between the compound states obtained in the study of (n, γa) reaction on these nuclei. A comparison of the estimates with the experimental values obtained for total radiative widths reveals a growth of radiative strength functions at Esub(γ) > 1.6 MeV as compared with their values in the interval from 0.2-1.6 MeV. The estimates are also made for the radiative strength functions averaged over the energy interval from 1.6 to 4 MeV.

## 6518 Nuclear Properties And Reactions, A=150-189

**39683 (CEA-CONF—6453) Direct interaction of fast neutrons with β and γ vibrational band levels of tungsten even isotopes.** Delaroche, J.P. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Sep 1982. 2p. (In French). (CONF-820942—24). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701993.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

As an extension of a previous report on fast neutron scattering from the first and second excited states of $^{182}$W, $^{184}$W, $^{186}$W, we have investigated the question of the importance of direct interaction of neutrons with β- and γ-band levels of these nuclei. For that purpose we have performed new coupled channel calculations using extended coupling bases and collective functions from the Rotation-Vibration and Kumar and Baranger Models. The predictions are compared with recent scattering data obtained at incident energies below 4 MeV.

**39684 (DOE/ER/40048—54-L3) Excitation of low-lying collective bands in inelastic hadron scattering.** Harakeh, M.N. (Washington Univ., Seattle (USA). Nuclear Physics Lab.; Rijksuniversiteit Groningen (Netherlands). Kernfysisch Versneller Inst.). 1983. Contract AC06-81ER40048. 22p. (CONF-830598—1). NTIS, PC A02/MF A01. Order Number DE83013489.

From RCNP symposium on light ion reaction mechanism; Osaka, Japan (16 May 1983).

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We consider the excitation of β- and octupole bands in permanently deformed nuclei in the framework of the coupled-channel method. Transition densities for the β- and octupole bands derived from the ground-state density and satisfying, respectively, the conditions of particle conservation and translational invariance are presented. Transition potentials derived from optical-model potentials along similar lines are used in the coupled-channel analysis of inelastic hadron scattering fom β- and octupole bands in deformed nuclei. The coupling of giant-resonance modes into these low-lying bands manifesting themselves in additional terms to the transition densities is discussed.

**39685 (DOE/ER/40048—55-L3) Form factors and coupled-channel analysis of inelastic excitations of low-lying collective bands in rotational nuclei.** Harakeh, M.N. (Washington Univ., Seattle (USA). Nuclear Physics Lab.; Rijksuniversiteit Groningen (Netherlands). Kernfysisch Versneller Inst.). 1983. Contract AC06-81ER40048. 37p. (CONF-830599—1). NTIS, PC A03/MF A01. Order Number DE83013243.

From RCNP Kikuchi summer school; Kyoto, Japan (23 May 1983).

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Form factors for small-amplitude vibrations superposed on static deformations are considered. Particular attention is given to form factors of low-lying β-, γ- and octupole bands in statically deformed nuclei. The use of these form factors in coupled-channel analysis of inelastic-hadron-scattering differential cross sections for excitation of low-lying collective bands in deformed nuclei is discussed. Specific examples ranging from $^{12}$C to $^{166}$Gd are considered.

**39686 (JINR—1-82-235) Methodical corrections to multiplicity of πp mesons produced in relativistic nuclei interaction in propane bubble chamber.** Agakishev, G.N.; Baatar, Ts.; Gasparyan, A.P.; Ivanovskaya, I.A.; Kladnitskaya, E.N.; Mekhtiev, R.R.; Cheplakov, A.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702023.

Methodical corrections introduced into experimental data in determining mean multiplicity, momentum and angular distributions of $\pi^-$ - mesons produced in nucleus collisions in propane bubble chamber are described. The corrections include a loss of particles emitted by the large angles to the direction of incident particles, a particle absorption in the tantalum targets placed inside the chamber, an admixture of events in propane to ones produced in tantalum, an admixture of electrons to $\pi^-$ - mesons, a loss of particles due to the secondary interactions and so on. Total correction to the mean multiplicity equals to about 10%.

**39687 (JINR-R—7-82-321) $^{170}$Hf moment of inertia at spin of approximately 40 h/2π.** Petrov, B.F.; Kamanin, V.V.; Rudiger, J.; Ivanova, S.P.; Kraft, O.E.; Naumov, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702031.

This paper deals with an experimental study of the moments of inertia of atomic nuclei at high spins. The γ-ray continuous spectrum is investigated by means of a multiple-coincidence system that allows one to obtain the "multiplicity spectrum". It is found that the high-multiplicity spectra clearly exhibit a statistical spectrum and the maximum of forbidden transitions along the yrast-line. The shape of the statistical spectrum is the same as that calculated using the GROGI program. For $^{170}$Hf at spin 42h the moment of inertia was obtained to be equal to 138+-10 MeV$^{-1}$ which is close to the solid value.

**39688 (JINR-R—7-82-322) Multiplicity of γ-transitions in the sup160Gd(sup(16)O, xn)sup(176-x)Hf reaction. The limiting angular momentum.** Petrov, B.F.; Kamanin, V.V.; Rudiger, J.; Ivanova, S.P.; Kraft, O.E.; Naumov, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702032.

On the basis of the results of investigation of γ-decay of the high-spin states formed in the sup(160)Gd(sup(16)O, xn)sup(176-x)Hf reaction at $^{16}$O ion energies ranging from 80 to 134 MeV, the parameters of the spin distribution of the population of nuclear states in a compound nucleus are determined at different ion energies. To pass from the experimental values of the γ-ray multiplicities to these distribution parameters use is made of the results of statistical model calculations for a concrete reaction. The limiting values of angular momenta are obtained describing the nuclear state population spin distributions for the channels in which the competition begins between neutron and γ-emission.

**39689 (KIYI—81-19) Width evolution of the giant E1-resonance in heavy nuclei.** Gurevich, G.M.; Mazur, V.M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1981. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702033.

An analysis is carried out for evolution character of width GITA of the giant dipole resonance in the wide range of nuclear masses. The obtained semiempirical relations well describe the value and change of GITA widths in the 100 < A < 240 range.

## 6519 Nuclear Properties And Reactions, A=190-219

*REFER ALSO TO CITATION(S) 38930, 39664*

**39690 (BNL—32996) Non-selective (n,γ) reaction and the search for multi-j supersymmetries.** Casten, R.F. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 17p. (CONF-830138—3). NTIS, PC A02/MF A01. Order Number DE83013066.

From Symposium on nuclear physics; Oaxtepec, Mexico (4 Jan 1983).

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The IBA model leads to predictions for symmetries in even nuclei and supersymmetries encompassing both even and odd mass nuclei. Recently, there has been active interest in determining if there is evidence for the latter in actual nuclei. The most promising supersymmetry evolves from the group U(6/12), and involves the coupling of an 0(6) core to a fermion that can occupy j = 1/2, 3/2 or 5/2 orbits. It might be expected in the Pt isotopes near $^{196}$Pt. Since it incorporates all low lying single particle orbits, the supersymmetry scheme in odd mass nuclei should account for all low lying, low spin, negative parity states. Thus the experimental probe of choice is the non-selective (n,γ) reaction which can, in appropriate cases, disclose all such states. The essentials of the (n,γ) reaction are outlined leading to a discussion of its potential for complete spectroscopy. This is followed by discussion of the empirical results for $^{196}$, $^{197}$, $^{199}$Pt, of the nature and characteristics of the multi-j supersymmetry scheme, of the emerging evidence and systematics for it, and of the implications for alternate supersymmetry schemes.

**39691 (JINR—R-4-82-358) Fragmentation of deeply-bound hole states in $^{207}$Pb and sup(203,205,207)Tl.** Voronov, V.V.; Solov'ev, V.G.; Stoyanov, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702009.

Portions are illegible in microfiche products7 refs.; 3 figs.; 2 tabs.

Within quasiparticle-phonon nuclear model the fragmentation of some deeply-bound hole states in $^{207}$Pb and sup(203,205,207)Tl is calculated. The model wave function includes the "quasiparticle plus phonon" and "quasiparticle plus two phonons" components. The good agreement with the experimental data for the spectroscopic factors of low-lying in $^{207}$Pb and $^{207}$Tl is obtained. The integral characteristics of deeply-bound hole states, which are excited in the $^{208}$Pb($^{3}$He, α)$^{207}$Pb reaction, are correctly described.

**39692 (JINR-R—7-82-19) Effect of the excitation energy and angular momentum on the characteristics of fission fragments of the $^{208}$Po and $^{210}$Po compound nuclei.** Itkis, M.G.; Kalpakchieva, R.; Okolovich, V.N.; Penionzhkevich, Yu.Eh.; Tolstikov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702030.

By using the angular correlation method for measurement of the energies of two fission fragments, the mass and energy distributions of fragments in the fission of the compound nuclei $^{208}$Po and $^{210}$Po produced in reactions with $^{16}$O, $^{12}$C and $^{3}$He ions of different energies have been measured. The fission fragment total kinetic energy is found to grow with the increas of the angular momentum. This may indicate that there is a weak connection between the single-particle and the collective modes of motion in the fissioning nuclei and as a result of this the rotational energy transforms mainly into translational motion of the fission fragments.

**39693 (LBL—16136) Angular distributions of target fragments from the reactions of 292 MeV - 25.2 GeV $^{12}$C with $^{197}$Au and $^{238}$U.** Morita, Y. (California Univ., Berkeley (USA)). 20 May 1983. Contract AC03-76SF00098. 146p. NTIS, PC A07/MF A01. Order Number DE83013685.

Portions are illegible in microfiche products. Thesis.

Angular distributions of target fragments from the reactions of $^{12}$C with $^{197}$Au and $^{238}$U were measured at projectile energies of 292 MeV, 1.0 GeV, 3.0 GeV, 12.0 GeV and 25.2 GeV. The angular distributions of the $^{197}$Au target fragments were all forwardly peaked. Extensively forward peaked angular distributions were observed at the non-relativistic projectile energies (292 MeV, 1.0 GeV). No obvious differences were observed in the angular distributions at the different relativistic projectile energies of 3.0 GeV, 12.0 GeV and 25.2 GeV. The characteristic angular distribution pattern from the relativistic projectile energy experiments was also observed in the non-relativistic energy experiments. Maximum degree of forward-peaking in the angular distributions at each projectile energy was observed at the product mass number (A) around 190 from the 292 MeV projectile energy, at A=180 from 1.0 GeV and at A=175 from 3.0 GeV and 12.0 GeV. In general, two different types of angular distributions were observed in the relativistic projectile energy experiments with the $^{238}$U target. Isotropic angular distributions were observed for the fission product nuclides. The angular distributions of the fission products at the intermediate (292 MeV) energy showed slightly forward- peaked angular distributions. Because of the long projectile-target interaction time in the primary nuclear reaction, larger momentum was transferred from the projectile to the target nucleus. Steep forward-peaked angular distributions were also observed with the $^{238}$U target.

## 6520 Nuclear Properties And Reactions, A=220 And Above

*REFER ALSO TO CITATION(S) 39664, 39693*

**39694 (AEEW-R—1407) Radioactive heavy-element decay data for reactor calculations.** Nichols, A.L.; James, M.F. (UKAEA Atomic Energy Establishment, Winfrith). Dec 1981. 441p. AEEW, Winfrith Dorchester, Dorset, England.

An evaluation has been made of the decay data for 125 heavy-element nuclides of interest in nuclear-fuel-cycle calculations. Computer-based data files have been produced in ENDF/B-V format, listing the data references used to formulate the proposed decay schemes and identifying their inadequacies. Evaluated data include half-life; total decay energies; branching ratios; alpha, beta, and gamma energies and intensities; spontaneous-fission decay data; average energies, internal conversion coefficients, and associated uncertainties. Tabulations of the data are presented by means of a variety of computer codes.

**39695 (BNL-NCS—33026) Preliminary evaluation of the $^{235}$U(n,f) cross-section from 100 keV to 20 MeV.** Bhat, M.R. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 16p. (CONF-830362—1). NTIS, PC A02/MF A01. Order Number DE83013116.

From IAEA consultants' meeting on the uranium 235 fast-neutron fission cross section; Smolenice, Czechoslovakia (28 Mar 1983).

A preliminary evaluation of the fission cross-section of $^{235}$U from 100 keV to 20 MeV is described. Variance-covariance matrices for a number of experimental data sets were constructed and used to evaluate the fission cross-section following a Bayesian procedure. The evaluated fission cross-section is compared with experimental data including the $^{252}$Cf fission neutron spectrum averages and some of the problems encountered in carrying out the fit are discussed.

39696 **(CEA-CONF—6451) Measurement of the average number of prompt neutrons νp, and the average prompt gamma-ray energy Eγ for the neutron induced fission of $^{233}$Th, $^{235}$U and $^{237}$Np in the energy range from 1 up to 15 MeV.** Frehaut, J.; Bertin, A.; Bois, R. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Sep 1982. 4p. (In French). (CONF-820942—26). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702017.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

The average number of prompts neutrons, average νp, and the average prompt gamma-ray energy, average Eγ, have been measured for the neutron induced fission of $^{233}$Th, $^{235}$U, and $^{237}$Np in the energy range from 1 up to 15 MeV. For $^{235}$U and $^{237}$Np, average νp is approximately a linear function of energy with small changes in slope around 4 MeV and around 6 MeV and 12 MeV. For $^{233}$Th the second chance fission results in a strong increase of average νp, due to the increase of the fragment total kinetic energy with excitation energy for that nucleus. A linear correlation observed between average Eγ and average νp is interpreted in terms of a competition between neutron and gamma-ray emission, connected with an increase of the average angular momentum of the fission fragments with excitation energy. The variance of the fission neutron multiplicity distributions is observed to be proportional to the excitation energy of the fissioning nucleus.

39697 **(CONF-830214—3) Directions for nuclear research in the transplutonium elements.** Wilhelmy, J.B.; Chasman, R.R.; Friedman, A.M.; Ahmad, I. (Los Alamos National Lab., NM (USA); Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 51p. NTIS, PC A04/MF A01. Order Number DE83010724.

From Workshop on future directions in transplutonium element research; Washington, DC, USA (28 Feb 1983).

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The study of the heavy nuclides has played a vital role in our understanding of the alpha decay process, nuclear fission, nuclear binding energies and the limits of nuclear stability. This study has led to the understanding of novel shape degrees of freedom, such as the very large quadrupole deformations associated with the fission isomer process, and the very recently discovered octupole deformation. The existence of these unique phenomena in the heavy element region is not accidental. Fission isomerism is due to the delicate balance between nuclear forces holding the nucleus together and Coulomb forces causing nuclear fission. Octupole deformation arises from the increasing strength of matrix elements with increasing oscillator shell. Both illustrate the unique features of the heavy element region. Fission studies have given us information about large collective aspects in nuclei and the importance that nuclear structural effects can play in altering these macro properties. A new class of atomic studies has become possible with the availability of heavy elements. With these isotopes, we are now able to produce electric fields of such magnitude that it becomes possible to spontaneously create positron-electron pairs in the vacuum. We have organized this presentation into three major sections: nuclear structure, fission studies and atomic studies of supercritical systems. In each we will try to emphasize the new directions which can benefit from the continued availability of isotopes supplied by the Trans-plutonium Production Program. 117 references. (WHK)

39698 **(DP-MS—83-10) Total neutron cross sections of berkelium-249 and californium-249 below 100 eV.** Benjamin, R.W.; Harvey, J.A.; Hill, N.W.; Pandey, M.S.; Carlton, R.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Oak Ridge National Lab., TN (USA)). 1979. Contract AC09-76SR00001. 35p. NTIS, PC A03/MF A01. Order Number DE83013681.

The neutron total cross sections of $^{249}$Bk and $^{249}$Cf have been measured from 0.03 to 100 eV using the Oak Ridge Electron Linear Accelerator (ORELA) as a source of pulsed neutrons. The 1.6 mm dia. cylindrical transmission samples contained initially up to 5.3 mg of 98% $^{249}$Bk and 2% $^{249}$Cf: 4.5 years later, when the final measurements were made, the composition of the samples had become 2.5% $^{249}$Bk, 96.9% $^{249}$Cf, and 0.6% $^{245}$Cm. Samples were cooled with liquid nitrogen to reduce Doppler broadening. Thirty-nine resonances were identified in $^{249}$Bk and analyzed using a single-level Breit-Wigner formalism. Fifty-five resonances were identified in $^{249}$Cf and analyzed using an R-matrix multilevel formalism. Fifty-five resonances were identified in $^{249}$Cf and analyzed using an R-matrix multilevel formalism. The resonance parameters obtained have been used to determine the average level spacings and the s-wave neutron and fission strength functions. Where possible, bound-level parameters were derived to fit the thermal neutron total cross section data.

39699 **(IAE—3476/2) Superheavy elements.** Zakharova, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702022.

Portions are illegible in microfiche products4 refs.; 7 figs.

The paper deals briefly with the results of a series of theoretical and experimental studies on the search for superheavy elements (Z=114, N=184). A hypothesis on the relation between shell structure of initial nuclei and the analogous characteristics of their fission fragments is suggested. According to this hypothesis the twice magic nucleons Z=114, N=184 preferentially are divided into fragments caused by magic numbers Z=28 (or 32), N=50 and Z=82, N=126. As the $^{258}$Fm and $^{260}$Fm nuclei study has shown fragments "magic" to a great extent destabilizes the initial nucleus. It is not excluded therefore that instead of stability island there exists an instability crater with coordinates Z=114, N=184.

39700 (INDC(CCP)—177/L, pp 1-5) **Evaluation of excitation functions for (n,2n) and (n,3n) reactions involving fissile nuclei.** Bychkov, V.M.; Plyaskin, V.I. May 1982. NTIS (US Sales Only), PC A04/MF A01.

Translated from Russian.

In Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).

In the present paper we suggest a method of calculating the cross-sections for the (n,2n) and (n,3n) reactions based on the use of simplified versions of the statistical model and the exciton model.

39701 (INDC(CCP)—177/L, pp 39-42) **Measurements of the energy dependence of the mean number of prompt neutrons in neutron-induced fission of $^{237}$Np nuclei.** Vorob'eva, V.G.; Kuz'minov, B.D.; Malinovskij, V.V.; Semenova, N.N. May 1982. NTIS (US Sales Only), PC A04/MF A01.

Translated from Russian.

In Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).

Measurements of the mean number of prompt neutrons nu-barsub(p) in neutron-induced fission of $^{237}$Np nuclei in the energy range 1-6 MeV were carried out relative to the value nu-barsub(p) = 3.733 for spontaneous fission of $^{252}$Cf.

39702 (INDC(CCP)—177/L, pp 43-47) **Analysis of the energy dependence of the average number of prompt neutrons for neutron-induced fission of $^{238}$U.** Vorob'eva, V.G.; Kuz'minov, B.D.; Malinovskij, V.V.; Piksajkin, V.M.; Semenova, N.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.); Valyavkin, V.S.; Solov'ev, S.M. (Radievyj Inst., Leningrad (USSR)). May 1982. NTIS (US Sales Only), PC A04/MF A01.

Translated from Russian.

In Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).

The average number of prompt neutrons, nu-barsub(p), for neutron-induced fission of $^{238}$U was measured relative to nu-barsub(p) = 3.733 for spontaneous fission of $^{252}$Cf. A detailed description of the measurement method is given in other papers. Here we shall merely mention some of its special features concerning $^{238}$U measurements.

39703 (INDC(CCP)—177/L, pp 49-52) **Energy and angular distributions of neutrons from $^{252}$Cf spontaneous fission.** Vasil'ev, Yu.A.; Sidorov, L.V.; Vasil'eva, N.K. May 1982. NTIS (US Sales Only), PC A04/MF A01.

Translated from Russian.

In Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).

Some results from a first series of measurements of energy and angular distributions of neutrons from $^{252}$Cf spontaneous fission using a spectrometer with high neutron detection efficiency, i.e. a $4\pi$ neutron time-of-flight spectrometer, were already presented. Subsequently, a second series of measurements was performed using a more sophisticated technique. For this second series, we used a more intense $^{252}$Cf layer (25,000 spontaneous fissions per second). The angular resolution was improved by a factor of 2-3 by combining the hexahedral counter modules, placed at the same angle with respect to the direction of motion of the fragments, in new panoramic counters. The neutron counters were calibrated against the average $^{252}$Cf neutron spectrum at several positions of the axis of the fragment detector with respect to the neutron counters. In the spectrum measurements and calibration work, the scattered neutron background was not determined theoretically, as in the first series of measurements, but experimentally using four extra scintillation counters with scatter cones; the counters were set up at 60 deg., 80 deg., 100 deg., and 120 deg. to the direction of separation of the fragments.

39704 **(INDC(CCP)—177/L) Translation of selected papers published in Nuclear Constants, Volume 1(40) Moscow (1981).** (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). May 1982. 63p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83780702.

Separate abstracts were prepared for papers from Nuclear Constants, Volume 1(40), Moscow (1981). (KAW)

39705 (INIS-SU—145, pp 309-312) **Lifetime of $^{236}$U compound nuclei at the 8.6-10.6 MeV excitation energy.** Vorotnikov, P.E.; Grusha, O.V.; Eremin, N.V.; Larionov, L.S.; Melikov, Yu.V.; Syutkina, L.N.; Tulinov, A.F.; Turinge, A.A.; Chechenin, N.G.; Yuminov, O.A. 1980. (In Russian). NTIS (US Sales Only), PC AXX/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

The paper deals with measuring the $^{236}$U nucleus life time at 8.6; 9.0; 9.7 and 10.6 MeV excitation energies. The $^{3}$H(p, n) reaction is used for obtaining monoenergy neutrons. The $UO_2$ monocrystal enriched with $^{235}$U isotope up to 90% was cooled down to the liquid nitrogen during the experiment temperature. Fission fragments were registered in the neighbourhood of the two crystallographical axes <111> constituting 10 and 81 deg angles with the beam direction by means of glass track detectors. For obtaining the spatial distribution of fission fragments the detectors were subjected to the corresponding chemical treatment, then they were examined by means of microscope. The function of level density in the traditional Fermi-gas model as well as the modern phenomenological description with account of pair correlations and collective effects were used in the calculations. The agreement between the theoretical curve and the experimental data is quite agreeable. The earlier outlined tendency to essential divergence between the theoretical and experimental dependences of $^{235}$U nucleus life time on the excitation energy in the range $F^{*} > 8$ MeV is not proved.

39706 **(JINR-R—7-81-863) Experiments on the transfermium element production in nuclear reactions induced by magnesium ions.** Vas'ko, V.M.; Gul'bekyan, G.G.; Tret'yakova, S.P.; Cherepanov, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702029.

The $^{253}$Th, $^{238}$U, $^{243}$Am targets were bombarded with magnesium ions accelerated at the U-400 cyclotron. The Tsub(1/2) > 3 ms reaction product spontaneous fission fragments were detected by means of mica detectors. The Tsub(1/2)=16+-7 ms spontaneous fission activity seems to be due to sup(242f)Am isomer decay observed in the $^{243}$Am + $^{26}$Mg reaction. The experimental results are compared with theoretical calculations of $^{252}$102, $^{260}$Ku and $^{246}$107 isotope production cross sections.

## 6530 Nuclear Theory

*REFER ALSO TO CITATION(S) 39612*

39707 **(CEA-CONF—6450) Feedback of coupling to giant resonances for fast neutron elastic and inelastic scattering.** Delaroche, J.P.; Guss, P.; Floyd, C.E.; Walter, R.L.; Tornow, W. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Sep 1982. 2p. (In French). (CONF-820942—23). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701992.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

While the inelastic scattering of high energy hadrons is commonly used for the study of giant resonances in nuclei, it is just recently that one has thought to take into account these states in the analysis of proton scattering at low incident energies (E< or approximately 50 MeV). Feedback of coupling to giant resonances on optical model predictions are investigated for fast neutron elastic and inelastic scattering from vibrational nuclei and for neutron strength functions $S_0$ and $S_1$.

39708 **(CEA-CONF—6454) Fluctuation properties of nuclear energy levels and widths: comparison of theory with experiment.** Bohigas, O.; Haq, R.U.; Pandey, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1982. 6p. (CONF-820942—25). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701994.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

We analyze the fluctuation properties of nuclear energy levels and widths with new spectrally averaged measures. A remarkably close agreement between the predictions of random-matrix theories and experiment is found.

39709 **(CEA-CONF—6476) Fast fission: a dissipative mechanism sometimes following fusion.** Ngo, C.; Gregoire, C.; Remaud, B.; Tomasi, E. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1982. 15p. (CONF-820979—6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701995.

From International conference on nucleus-nucleus collisions; East Lansing, MI, USA (27 Sep 1982).

We discuss the conditions under which the fusion of two heavy ions is possible. We describe the results of a dynamical model for dissipative heavy ion collisions which shows that a fused trajectory can lead either to a compound nucleus, or to fast fission. This latter process is a mechanism which is intermediate between compound nucleus formation and deep inelastic reactions. The conditions under which fast fission occurs are discussed in details. The results of the model are compared with experimental data suggesting the existence of fast fission.

39710 **(FEI—1260) SMT-80 program: cross section calculation of binary reactions in framework of statistical model.** Titarenko, N.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. 29p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701996.

The program of angular and energy characteristics of two-partical reactions calculation in the framework of the Hauser-Feschbach statistical model is described. Correction for fluctuation of level widths is realized in the approximation of Moldauer, Tepel and others. There is a possibility to take into account up to nine competitive channels of the compound-nucleus decay with escape of light or heavy fragments with spin 0, 1/2, 1. Different radiation capture and fission variants may be considered as well. A compound nucleus may decay into discrete states as well as into the field of statistically distributed forhidden levels. The required penetration coefficients for particles and fragments are calculated in the framework of a spherical optical model, various representations on the compound-nucleus level density are used. The program is written in FORTRAN-4 for the BEMS-6 computer.

**39711 (IAE—3456/2) Cluster basis method for the microscopical description of light nuclear systems.** Ehfros, V.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701997.

Microfiche only, copy does not permit paper copy reproduction8 refs.

Matrix elements of a cluster model in the case of the processes involving the lightest clusters with A <= 4 are calculated analytically on the basis of the internal wave cluster function meeting realistic NN interactions. A new simple representation of wave cluster functions is used. A variational principle for the solution of resonance problems is formulated. Methods of approximate account of repulsive core in NN interaction and long-range Coulomb cluster repulsion are considered. The approach is efficient for the description on a consistent microscopic basis, proceeding from realistic NN interactions, two-particle reactions and resonances in the systems with A=4 5 and, possibly, with 6 <= A <= 8.

**39712 (IC—80/149) Effect of meson exchange corrections on allowed muon capture.** Parthasarathy, R.; Sridhar, V.N. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1980. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701672.

Corrections to the impulse approximation calculations of $\gamma$-nu angular correlation coefficient and recoil nuclear polarization in allowed nuclear muon capture transitions, arising from the meson exchange effects are studied and a value for the induced pseudoscalar coupling consistent with both the observables is found to be (13.3 +- 3)gsub(A), to a large extent free from nuclear wave function uncertainties, indicating the possible presence of second class axial vector current.

**39713 (ITF—82-57-R) Differential formulation of the scattering problem for the N-body system.** Merkur'ev, S.P.; Yakovlev, S.L. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1982. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701999.

9 refs.

For the N-body system the differential equations for the Yakubovskij resolvent components and the wave functions are obtained. The equivalence of these equations to the Yakubovskij integral equations is shown. The case for the charged particle system is considered alongside with the neutral particles.

**39714 (JINR—R-4-82-183) Electromagnetic transitions between high-excited states of deformed nuclei.** Malov, L.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702006.

Portions are illegible in microfiche products4 refs.; 1 fig.

The $\gamma$-transitions between the excited states of deformed nuclei near the nucleon binding energy are considered. The structure of these states is complex, and their density is very large. As a result of the averaging over the initial and final states, the reduced probability of electromagnetic transitions is written as a strength function. Thus, the solution of the complex problem of eigenvalues and the determination of all possible transitions between the nuclear states is reduced to the calculation of the above strength function depending on two continuous variables, initial and finite transition energies. The proposed method for description of the transitions between the states with large density can be applied for many problems of nuclear physics (in particular, for the calculation of the cross sections of different decay channels of the gaint resonances). It also allows one to perform a microscopic calculation of some physical properties of these transitions, obtained from experiment.

**39715 (JINR-D—10-11-81-622, pp 219-231) Computer simulation of direct nuclear reactions with d, t, $^3$He and alpha particle yields.** Kadmenskij, V.G.; Kadmenskij, S.G.; Ratis, Yu.L. (Voronezhskij Gosudarstvennyj Univ. (USSR)). 1981. (In Russian). Joint Inst. for Nuclear Research, Dubna, USSR. (CONF-8009243—).

From International meeting on problems of mathematical simulation in nuclear physics researches; Dubna, USSR (30 Sep 1980).

Portions are illegible in microfiche products5 refs.; 3 tabs.

The method of investigation of inclusive direct nuclear reactions is developed in the study. It may be generalized for the case of knocking out heavier fragments, for example, t, $^3$He and $\alpha$-particles. Wave functions at short relative distances for the above nucleon associations in nuclei in the model of nucleon- nucleon correlations (NNC) are proportional to internal wave functions of corresponding free particles. Proportionality coefficients Csub(t)(Csub(sup(3)He)) and Csub($\alpha$) meet three-particle and four-particle NNC. They can be derived by comparison of theoretically calculated values (d$\sigma$/d$\Omega$t)sup(p, p't) and (d$\sigma$/d$\Omega\alpha$)sup(p, p'$\alpha$) with the experimentally measured cross sections of the above reactions. Thus the NNC model permits in a common approach to describe a wide range of nuclear reactions with compound particles, in which owing to large momentum transfer the basic contribution into the cross section is given by short relative internucleon distances.

**39716 (JINR-R—2-82-260) Green function and pion polarization operator in nuclear matter.** Bunatyan, G.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702001.

Portions are illegible in microfiche products5 refs.; 1 fig.

For the investigation of the nuclear matter properties near the $\pi$-condensation critical point the general expressions for polarization operator PI and the Green function D of the pion in the nuclear matter are obtained taking into account the $\pi\pi$-interactions. These quantities PI, D are calculated with the methods of the quantum statistics, in particular, with the finite Fermi system theory, for non-zero temperatures T not equal to 0. The contributions in D, PI of the pion field non-linear processes, that is of the pion excitation anharmonism in the medium, are obtained and investigated.

**39717 (JINR-R—2-82-261) Pion field in the isotropic nuclear matter.** Bunatyan, G.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702002.

Portions are illegible in microfiche products8 refs.

The pion polarization operator PI in homogeneous nuclear matter is investigated near the $\pi$-condensation critical point both for temperature T=0 and for T not equal to 0. It is demonstrated that PI calculated making allowance for the $\pi\pi$-interactions, at T=0 does not contain the divergencies connected increase near the critical points leads to divergency of PI. It is cleared up under what conditions it is possible to restrict the calculation of PI with accounting only of simplest diagrams.

**39718 (JINR-R—2-82-262) Properties of nuclear matter in inhomogeneous phase and conditions of $\pi$-condensation.** Bunatyan, G.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702003.

Portions are illegible in microfiche products7 refs.

The polarization operator of the pion field in the inhomogeneous nuclear matter in the presence of the mean periodic classical pion field is studied. The conditions which determine the phase transition with pion condensate formation and the closeness of the nuclei to the $\pi$-condensate instability are investigated.

**39719 (KFTI—82-9) Processes $e^-(\nu)+A \rightarrow e^-(\nu)+h+A'$ and weak neutral currents.** Rekalo, M.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702013.

Paper copy only, copy does not permit microfiche production4 refs.

It is shown for the processes of inelastic electron scattering by nuclei, accompanying by the h particle escape from the nucleus, $e^- + A \rightarrow e^- + h + A'$, A and A' are certain nuclei, that the differential cross section dependence of these processes with detect-

ing two particles in final state from two of five possible kinematic variables can be established in a general form. Dynamics of these processes is not specified but only most general amplitude properties (such as conservation of electromagnetic hadron current, locality of weak lepton-hadron interaction etc.) are used. Such approach permits to establish the dependence of P odd effects in $e^- + A \rightarrow e^- + h + A'$ on azimuthal angle (angle between electron scattering plane and hadron production plane h+A') and on specific combination of kinematic electron variables in initial and final states which determines the linear polarization degree of the virtual photon. P-odd effects in $e^- + A \rightarrow e^- + h + A'$ may be due either to P-odd nuclei forces or to weak neutral currents (of electron and hadrons). Similarly the general structure of differential cross sections of the $\nu$(anti $\nu$)+A $\rightarrow$ $\nu$(anti $\nu$)+h+A' processes caused by neutral weak currents has been found.

**39720 (KINR—81-30) Nuclear reaction duration at the range of overlapping resonances.** Olkhovsky, V.S. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1981. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83702014.

Portions are illegible in microfiche products1 refs.

Nuclear reaction duration above the threshold of overlapping resonances is investigated and its importance to obtain a new information on a collision mechanism is evidenced. It is shown also that the duration of resonant nuclear reactions is asymptotically decreasing according to the law$[E^2n(E)]^{-1}$ when the energy E and the number of open channels n(E) are increasing.

**39721 (LA-UR—83-1310) $SO_8$ model of collectivity in nuclei.** Ginocchio, J.N. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 25p. (CONF-830143—1). NTIS, PC A02/MF A01. Order Number DE83012683.

From Workshop on bosons in nuclei; Philadelphia, PA, USA (28 Jan 1983).

The interacting boson model (IBM) has been very successful in giving a unified and simple description of the spectroscopic properties of a wide range of nuclei, from vibrational through rotational nuclei. The three basic assumptions of the model are that (1) the valence nucleons move about a doubly closed core, (2) the collective low-lying states are composed primarily of coherent pairs of neutrons and pairs of protons coupled to angular momentum zero and two and (3) these coherent pairs are approximated as bosons. Thus the IBM is an approximation to the nuclear shell model in which the number of degrees of freedom are reduced drastically. Once these assumptions are made, the effective Hamiltonian can then be written in terms of neutron monopole (angular momentum zero) and quadrupole (angular momentum two) bosons and proton monopole and quadrupole bosons. Since each nucleus will have a fixed number of nucleon pairs this boson Hamiltonian will conserve the number of bosons. Phemonologically, the Hamiltonian is assumed to be finite and to be a sum of a boson self-energy Hamiltonian plus pairwise interactions between bosons. However, the parameters of the boson Hamiltonian depend smoothly on the mass of the nucleus. The mass dependence of these parameters presumably arise because of two effects resulting from the approximations made. In this review we shall show how it is possible to have fermion Hamiltonians which have a class of collective eigenstates composed entirely of monopole and quadrupole pairs of fermions. Hence these models satisfy the assumptions (1) and (2) above but no boson approximation need be made. Thus the Pauli principle is kept in tact. Furthermore the fermion shell model states excluded in the IBM can be classified by the number of fermion pairs which are not coherent monopole of quadrupole pairs. Hence the mixing of these states into the low-lying spectrum can be calculated in a systematic and tractable manner.

**39722 (ORNL/TM—8769) Dynamical fusion thresholds in macroscopic and microscopic theories.** Davies, K.T.R. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 49p. NTIS, PC A03/MF A01. Order Number DE83013736.

We present macroscopic and microscopic results which illustrate the effects of the extra-push dynamics in heavy-ion fusion. As the charge or angular momentum of the system increases, it becomes more difficult to describe the detailed fusion behavior by simple one-dimensional models, so that macroscopic calculations must be done in a multi-dimensional configuration space. We show the sensitivity of the macroscopic results to various details of the models, e.g. the nuclear macroscopic energy, the shape parametrization, and the dissipation mechanism. We compare our results calculated for symmetric systems with experimental values for asymmetric systems by use of a tentative scaling $(Z^2/A)$/sub mean/, defined as the geometric mean of $Z^2/A$ for the combined system and an effective value $(Z^2/A)$/sub eff/ for the projectile and target. In addition, we demonstrate how the extra-push results are affected by changes in bombarding energy, fissility, angular momentum, and degree of mass-asymmetry. For mass-asymmetric systems, we give the definition of a conditional saddle point and present examples of the fast-fission process. In microscopic TDHF theory there are several interesting new dynamical features, including an enhancement of fusion behavior at low energies near the interaction barrier. Also, two distinct types of dynamical fusion thresholds occur in TDHF studies: (1) the microscopic analogue of the macroscopic extra push threshold and (2) the relatively high energy at which the TDHF angular momentum window opens. Both of these microscopic thresholds are found to be very sensitive to the choice of the effective two-body interaction.

## 6540 Radiation And Shielding Physics

*REFER ALSO TO CITATION(S) 38930, 39149, 39514*

**39723 (AERE-MPD/NBS—206) Neutron diffraction studies of water in meso- and micro-pores.** Steytler, D.C.; Dore, J.C.; Wright, C.J. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). Jul 1982. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701643.

Neutron diffraction studies have been made for $D_2O$ water in two high surface-area silica samples, Spherisorb and Gasil. The results show that the structural arrangement is similar to that of bulk water and that the modification due to the interface is restricted to a range of the order of 10 A or less. Measurements also indicate that the dispersed water undergoes significant structural changes with temperature variation but the behaviour is similar to that of the bulk liquid. The differences observed in the diffraction patterns can be partially described in terms of diffraction broadening due to the small volume of the dispersed water but there remains a significant variation which appears to be related to the hydrogen-bonding interactions.

**39724 (AERE-R—10432) MORSE-H: a revised version of the Monte Carlo code MORSE.** Taylor, N.P.; Needham, J. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). May 1982. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701990.

A revised version of the Monte Carlo neutron and photon transport code, MORSE, has been formed by combining the most useful features of several versions as well as the addition of a few new facilities. The input data required for this version is summarized, as in the use of a JCL procedure written to simplify the running of the code on the Harwell central computer.

**39725 (CEA-CONF—6354) Search of tendencies.** Reuss, Paul. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). May 1982. 13p. (CONF-820566—11). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701691.

From Thermal reactor benchmark calculations, techniques, results and applications seminar; Upton, NY, USA (17 May 1982).

The search of tendencies is a method based on the probability formalism to try and use in the best possible way the integral results in order to improve the basic data of a computer code. This method is here illustrated by results obtained during the qualification of the neutron transport code APOLLO.

**39726 (IFVE-OP—81-166) Possibilities for radiation polarization of high-energy electron-positron beams in bent monocrystals.** Mikhalev, V.L.; Rzaev, R.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701905.

An explicit form of the quasiclassical equation of vector spin motion in an electromagnetic field with account for radiation damping, valid at any value of the parameter chi=h/2π/mcx' vector w '/c²xy² where vector w is particle acceleration is presented. A solution for this equation has been found particles, captured in plane channeling mode when passing through a slightly bend single crystal in the chi << 1 approximation. Averaging has been performed over the levels of transverse energies for a thin crystal. Beam angular divergence influence on its polarization has been estimated. A possibility to obtain polarized electron ( approximately equal to 40% polarization) and positron (65% polarization) beams has been show. Polarization has been estimated for chi >> 1.

**39727 (INIS-SU—145, pp 152-156) Study of stopped $\mu^+$-meson interactions in silicon monocrystals.** Barsov, S.G.; Getalov, A.L.; Gordeev, V.A. 1980. (In Russian). NTIS (US Sales Only), PC A14/MF A01. (CONF-7905159—Pt.1).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

Investigations of the temperature dependence of the residual polarization and relaxation time of $\mu^+$-meson spin in weak-doped silicon monocrystals of the n- and p-type within the 78-700 K temperature range are conducted. Relative ratio of polarized muons included in each state ($\mu^+$, Mu and Mu*) and the depolarization rate occuring during the observation time at different temperatures have been determined in the experiment. Some models are suggested for the description of different states of $\mu^{+-}$ meson in the substance. One of them is based on the fact that the muonium atom can be in different states of the crystalline lattice. Another model presupposes the chemical bond of both diamagnetic and paramagnetic types.

**39728 (ITEF—7(1982)) Two-group approximation in spherically symmetric problems of the transport theory.** Basko, M.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701991.

8 refs.; 2 figs.; 7 tabs.

A more general than the diffusion approximation class of two-group approximations is considered for the LTE equation of radiation transport and for the straight-trajectory equation of fast α-particles transport. In the case of spherical geometry the class of two-group approximations considered is characterized by the presence of an additional parameter Λ. It is shown that a reasonable choice of its value results in a significant improvement of the accuracy of the usual diffusion approximation in cases when the mean free path of radiation is comparable to or greater than the current value of radial coordinate r. It is shown also that for the energy transport by α-particles this improvement generally cannot be achieved.

**39729 (JEN—517) Neutron transport and Monte Carlo method: analysis and revision.** Perlado, J.M. (Junta de Energia Nuclear, Madrid (Spain)). 1982. 233p. (In Spanish). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83701692.

The resolution of the neutron transport equation by the Montecarlo method is presented. Coming from an extensive discussion on the best formulation of that equation in order to be treated through the mentioned method, the theoretical bases of the estimator and random-walk generation is extensively explained. The most general expresion for the estimators in different physical situations, each with a diverse random-walk, is included in this basical theoretical part. Furthemore, a large revision on the variance reduction methods is made. Its theoretical presentation is claimed to be in connection with the need for each one of them. The use of the adjoint equation, as a part of the importance sampling, Russian Roulette, splitting, exponential transform, conditional and correlated Montecarlo, and one-collision and next-event extimators, are discussed. Finally, come comments in the presentation of the last works on the theoretical prediction of errors in the generation of estimators-random walks are made.

**39730 (KFK—3430) Application of real, adjoint and bilinear weighting for collapsing group constants used in space neutron diffusion problems.** Kiefhaber, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Nov 1982. 62p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750677.

Conventional collapsing for group cross sections used in multigroup nuclear reactor calculations is usually performed using normal (real; direct) flux weighting. The application of more advanced collapsing procedures using in an appropriate manner real, adjoint and bilinear weighting was in the past restricted in general to fundamental mode problems. Although the principles have been published for more than ten years, there seems to exist little recent experience on the merits and possible difficulties of these improved procedures for multidimensional diffusion problems for practical purposes, e.g. in the nuclear design and analysis of large Liquid Metal Fast Breeder Reactors (LMFBRs). The present work indicates the nature of the problems which could possibly be encountered in applying these procedures by tracing them back to the known close correspondence between group collapsing and synthesis methods. It tries to explain certain somewhat unusual features of the collapsed group constants obtained by adjoint and bilinear weighting and describes the experience gained in representative 1-dim. and 2-dim. test cases. It could be shown for criticality and perturbation calculations that in general it is advantageous to apply these improved collapsing methods if the necessary precautions are taken. Compared to the conventional collapsing procedures these improved procedures are especially useful for multidimensional problems because their application is well suited for that purpose. In the present study it could be proven that they are favorable with respect to computer time and storage needed due to the fact that the necessary number of coarse groups can be kept fairly small without deteriorating too much the accuracy and reliability of the coarse group results compared to reference results of corresponding fine group calculations with uncollapsed group constants.

**39731 (KFTI—82-11) Orientation effects in relativistic particle scattering in monocrystals.** Truten', V.I.; Fomin, S.P.; Shul'ga, N.F. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1982. 27p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701913.

The elastic scattering process of fast charged particles moving in a crystal at a small angle psi to one of crystal axes is considered. Deviation functions, relativistic electron and positron scattering differential cross sections in the field of the Lindhard continuous potential have been found. It is shown that at electron scattering by a crystal atoms chain a phenomenon of rainbow scattering of superbarrier particles occurs. It is shown that at small angles psi the mean square scattering angle on crystal atom chains considerably exceeds the mean square scattering angle in amorphous medium and that maximum of these values ratio is attained under psi scale of the critical angle of channeling.

**39732 (SAND—83-0139C) Planar dechanneling studies of strained-layer superlattice structures.** Chu, W.K.; Ellison, J.A.; Picraux, S.T.; Biefeld, R.M.; Osbourn, G.C. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy; New Mexico Univ., Albuquerque (USA). Dept. of Mathematics; Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 18p. (CONF-830570—3). NTIS, PC A03/MF A01. Order Number DE83013307.

From 6. international conference on ion beam analysis; Temple, AZ, USA (22 May 1983).

We have investigated the influence of strain on the planar dechanneling of energetic particles in strained-layer superlattices (SLS). MOCVD-grown GaAs/sub x/P/sub 1-x//GAP samples of (100) orientation and periodicity of 19 and 29 nm per layer were

analyzed by MeV $^4$He channeling. Dechanneling measurements at a 45° tilt from the (100) along (110) directions which are inclined to the surface normal reveal a much higher dechanneling than along (110) directions which contain the surface normal, consistent with the tetragononal distortions present due to the strain. A theoretical phase plane analysis of the planar dechanneling is developed and it is shown that the amount of dechanneling is developed and it is shown that the amount of dechanneling depends not only on the strain-induced angular shift at each interface, but also on the ratio of the layer period to the channeled particle wavelength. This ratio has been adjusted by nearly a factor of 2 by varying the beam energy from 0.6 to 2.0 MeV. Both experiment and theory demonstrate that when the wavelength matches the layer thickness, there is a strong enhancement in the planar dechanneling due to the focusing of the particles into the planes.

**39733 (UCID—19813) RYLLA.** Hyde, R.A. (Lawrence Livermore National Lab., CA (USA)). 8 Jun 1983. Contract W-7405-ENG-48. 31p. NTIS, PC A03/MF A01. Order Number DE83013704.

This paper describes a computer code, RYLLA, which models the deposition of x-rays into thin metal slabs, and transports the resulting photoelectrons, finding the distribution of electrons leaving the slab from both the front and back surfaces. The slab must be homogeneous, but can contain a mixture of up to 5 different elements. Due to the short electron mean free path at low electron energies, RYLLA should be used only for studying thin slabs, roughly $<$ 100 mg/cm$^2$ for low Z metals, and $<$ 10 mg/cm$^2$ for high Z metals. X-ray energies should be in the range of 1 to 150 keV, as they are deposited only via photoionization and Compton scattering processes. Following photoionization, a hole exists in the electron cloud of the absorbing atom. This fills either by Auger or fluoresence, resulting in lower energy holes which are also filled. Fluoresence photons are transported and absorbed in the same manner as the primary photons, except that they are isotropically produced. Once all photons have been transported and absorbed, and all holes have been filled, a space- and energy-dependent electron source spectrum has been obtained. This is used in a discrete ordinate expansion solution of the 1-D transport equation, which gives the output electron spectra at the two slab surfaces. This paper discusses both the physics and coding of RYLLA. Examples of user input are given, as are some comparisons with other codes.

## 6550 Medical Physics

*REFER ALSO TO CITATION(S) 39225, 39308*

**39734 (UCRL—89142) Multigamma-ray calibration sources.** Meyer, R.A.; Massey, T.N. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 24p. (CONF-830585—1). NTIS, PC A02/MF A01. Order Number DE83011902.

From International committee for radionuclide seminar on applied radionuclide metrology; Gell, Belgium (16 May 1983).

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We have calibrated a self-consistent set of multigamma-ray standards using the automated multi-spectrometry γ-ray counting facility at LLNL's Nuclear Chemistry Division. Pure sources of long-lived activity were produced by mass separation and/or chemical purification. The sources were counted individually and in combination on several different calibrated spectrometer systems. These systems utilize various detectors ranging from small (x-ray) detectors to large volume high-purity Ge detectors. This has allowed the use of the most ideal individual detector-efficiency characteristics for the determination of the relative γ-ray intensities. Precise energy measurements, reported earlier (Meyer, 1976) have been performed by an independent method. Both the energy and γ-ray-emission probabilities determined compare well with independently established values such as the recent ICRM intercomparison of $^{166}$Eu. We discuss our investigations aimed at resolving the shape of the efficiency response function up to 10 MeV for large volume Ge(Li) and high-purity Ge detectors. Recent results on the γ-ray-emission probabilities per decay for $^{160}$Gd and $^{168}$Tm multigamma-ray sources are discussed. For $^{168}$Tm, we deduce a 0.01% $\beta^-$ branch to the 87.73-keV level in $^{168}$Yb rather than the previous value which was a factor of 200 greater. In addition, we describe current cooperative efforts aimed at establishing a consistent set of data for short-lived fission products. Included are recent measurements on the bromine fission products with γ rays up to 7 MeV.

## 6560 Solid State Physics

*REFER ALSO TO CITATION(S) 39139*

**39735 (CONF-830369—1) Spin-polarised band theory at finite temperatures.** Gyorffy, B.L.; Kollar, J.; Pindor, A.J.; Staunton, J.; Stocks, G.M.; Winter, H. (Bristol Univ. (UK). H.H. Wills Physics Lab.; Max-Planck-Institut fuer Festkoerperforschung, Stuttgart (Germany, F.R.); Toronto Univ., Ontario (Canada). Dept. of Physics; Oak Ridge National Lab., TN (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). 1983. Contract W-7405-ENG-26. 27p. NTIS, PC A03/MF A01. Order Number DE83012577.

From 3. metallic magnetism conference; Grenoble, France (25 Mar 1983).

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Starting from a Spin-Density functional description of electrons in a potentially ferromagnetic metal and the notion of temporarily broken ergodicity, a method is derived for performing finite temperature spin-polarized band theory with random local moment orientations. Formally, it is based on the KKR-CPA theory for randomly distributed spin-polarized scattering centers on a regular lattice. It is shown how the theory can lead to finite moments above the transition temperature, T/sub c/, and a Curie-Weiss law. We discuss the results of self-consistent spin-polarized KKR-CPA calculations in the disordered local moment (DLM) state for Fe, Co, Ni, and Cr.

**39736 (SAND—83-0407C) Hysteresis effects in deformable ceramics.** Chen, P.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830757—1). NTIS, PC A02/MF A01. Order Number DE83012872.

From IUTAM-IUPAP symposium on the mechanical behaviour of electromagnetic solid continua; Paris, France (4 Jul 1983).

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The responses of ferroelectric ceramics can be quite complex depending on the physical processes to which they are subjected. Their mechanical, electromechanical and dielectric properties depend on domain switching, dipole dynamics and phase transformation. A theory, which describes the responses of these materials, has been formulated, and it is sufficient to characterize various observable phenomena. Specifically, a special case of the theory predicts the nature of the butterfly and hysteresis loops. 4 figures.

**39737 (UWThPh—81-21) Thermodynamical phases and surface effects.** Narnhofer, H. (Vienna Univ. (Austria)). 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701914.

The Gibbs condition is used to consider, how different phases can be obtained by surface effects. A new argument is given, why broken continuous symmetry gives rise to long range correlations. Finally it is argued that mixed KMS-states are unstable under changes on the surface.

**39738 (UWThPh—81-22) Local temperature.** Narnhofer, H. (Vienna Univ. (Austria)). 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701915.

We show that for quasifree systems states with locally varying temperature can only exist on a macroscopic scale.

**39739 Theory of nonlinear optical absorption associated with free carriers in semiconductors.** James, R.B.; Smith, D.L. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, TN 37830). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **18**: No. 11, 1841-1864(Nov 1982).

The authors present calculations of the intensity dependence of the free-carrier absorption in semiconductors by high-intensity light with a wavelength near 10 μm. The first section examines the

nonlinear absorptive and dispersive properties associated with free-hole transitions in semiconductors, and the second section presents calculations of the nonlinear absorption associated with free-electron intraband transitions in germanium. The dominant free-hole absorption of $CO_2$ laser light for most p-type semiconductors with a diamond or zinc-blende crystal structure is direct intervalence band transitions where a hole in the heavy- (or light-) hole band absorbs a photon and makes a direct transition to another band within the valence band structure. The absorption coefficient due to this mechanism is found to decrease with increasing intensity in a manner closely approximated by an inhomogeneously broadened two-level model. The authors present detailed results for the saturation behavior of germanium as a function of temperature, wavelength, and doping density. Calculated values for the intensity dependence of the index of refraction and lowfrequency conductivity are presented. Calculated values of the saturation intensity are also given for most of the other Groups IV and III-V semiconductors. In several n-type semiconductors, the dominant absorption of 10 μm light is free-electron intraband transitions where an electron absorbs a photon and is excited to a state in the same band. The interaction of the electron distribution with the high intensity light increases the average energy of the electrons and leads to an increase in the free-carrier cross section. For sufficiently high intensities, a significant fraction of the electron density in the interaction region can have an energy greater than the bandgap (relative to the conduction band minimum) by successive one-photon intraband transitions.

39740 **Overlayer disregistry: transform simulations of LEED patterns.** Ellis, W.P.; Taylor, T.N. (Los Alamos National Lab., NM). *Surface Science;* **123**: 77-88(1982).

Optical transforms have been utilized to study characteristic low-energy electron diffraction features from overlayers on six-fold substrates, including (i) commensurates $\sqrt{3}$ overlayers reduced to 85%, (ii) orientationally incommensurate $\sqrt{3}$ structures, (iii) coincidence-lattices and (iv) several cases of one- and two-dimensional sinusoidal periodic lattice distortions. Readily identifiable, distinguishing differences are apparent among these classes of overlayer disregistry. The one prominent and distinctive feature common to periodic distortions on six-fold substrates is the absence of satellite beams around the 00 reflection for which a kinematical diffraction analysis is also given. The analogs graphically illustrate the possibility of misinterpretations.

## 6561 Superconductivity

*REFER ALSO TO CITATION(S) 39086, 39091, 39100, 39112, 39114, 39235*

39741 **(IAE—3493/10) Current-voltage characteristics of a superconductor with nonuniform critical current density.** Dorofeev, G.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701950.

7 refs.; 6 figs.

In approximation of low transverse currents as compared with the transport current the problem of searching for the electric fields and currents distribution in a superconductor with non uniform density of a critical current f(x, y) for the two-dimensional case is reduced to one integral equation. The problem with linear non uniformities f(nx+y) is solved. It is shown that the dimension (over the current) of the non-linear region of current-voltage characteristic is proportional to the angle square (α=arctg n) between critical current constant density lines and the sample axis (X axis). Electric field and current distributions in the multifibre superconducting cable are calculated. The calculation results are confirmed by the measurements of current-voltage characteristics of the multifibre cable on the basis of the HT-50 alloy with different twist pitches.

39742 **(SLAC-PUB—3075) RF superconducting properties of thin films on niobium.** Campisi, I.E.; Deruyter, H.; Farkas, Z.D.; Garwin, E.L.; Hogg, H.A.; King, F.; Kirby, R.E. (Stanford Linear Accelerator Center, CA (USA)). Mar 1983. Contract AC03-76SF00515. 3p. (CONF-830311—171). NTIS, PC A02/MF A01. Order Number DE83013108.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

We are investigating the RF properties of thin films of materials which are known to have low secondary emission coefficients, such as NbC, NbN and TiN. Preliminary measurements on the latter material have been performed by depositing a 15 nm film on parts of a doubly re-entrant Nb cavity designed to favor electron multipacting which, in the uncoated cavity, occurs copiously between the posts' tips. The measurements performed with TiN films sputtered onto Nb indicate that the RF current losses are increased by the presence of the films while the dielectric losses are negligible, within the measurement sensitivity of the system. The electron multipacting cannot be excited between the posts coated with the material tested.

## 6570 Theoretical Physics

*REFER ALSO TO CITATION(S) 39231, 39552*

39743 **(IFVE-OTF—82-5) Integrals of motion for closed relativistic strings.** Isaev, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 20p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701857.

A connetion of Hamiltonian and Lagrangian formulations of the closed string theory is studied. A complete set of conserved quantities is constructed with the help of the collective coordinate method. The completeness of some infinite systems of the conservation laws is discussed. A complete system of invariants for a smooth closed contour is gaven.

39744 **(IFVE-OTF—82-18) Neter theorems in the canonical formalism of general relativity. 2. Global approach.** Solov'ev, V.O. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701855.

In the framework of canonical formalism of the general relativity theory (GRT) a global variant of the Neter theorem is presented when the GRT effect for the total space is considered as finite time interval. The existence of the class of metrics, satisfying certain noncovariant boundary conditions, is shown, for which global approach to an invariant variational problem leads to generators of asymptotic translations Psup(μ). The expressions obtained for Psup(μ) are invariant only within the limits of a special class of coordinate transformations.

39745 **(IFVE-OTF—82-82) Classical dynamics of relativistic string.** Pron'ko, G.P.; Razumov, A.V.; Solov'ev, L.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701858.

A general solution to the equations of string motion is obtained. First, it is performed in orthonormal parametrization of evolution surface, then a case of random parametrization is considered. Particular attention is given to boundary conditions for an open string. The orthonormal parametrization of universe string surface can be introduced globally and in agreement with boundary conditions. The equivalence of Hamiltonian and Lagrangian equations of the string motion is demonstrated. The analysis of the form of universe string surface is conducted and a number of concrete examples is considered. It is shown that the universe string surface in the three-dimensional space-time is sure to be singular. The connection of universe surface singularities in the three-dimensional space-time with singular solutions to the Liouville equation has been found.

**39746 (IFVE-OTF—82-124) Traditional hamiltonian energy as defined in general relativity theory has no physical meaning.** Denisov, V.I.; Solov'ev, V.O. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701854.

For the last time it is stated in the number of studies that using the generalized Hamiltonian formalism in the general relativity theory (GRT) → the expression for the energy of the system consisting of a matter and gravitational field and to show its positive definiteness. On this basis in Faddeev works the conclusion has been drawn that the problem of energy-momentum of the gravitational field in the Einstein theory is solved, therefore the GRT needs neither in revision, nor in substitution. It is shown in the paper that this conclusion is drawn because of erroneous statement of the problem and the system energy determined in GRT on the basis of traditional generalized Hamiltonian approach depends on the choice of three-dimensional coordinate system, as a result of which it may take any arbitrary values.

**39747 (ITEF—83(1982)) Pattern recognition and quantum Mechanics.** Gerzon, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701860.

It is shown that fast pattern recognition may be realized in a number of cases by means of measurements over quantum systems. The quantum mechanics structure fits perfectly for statement and solution of the problems of pattern recognition. The recognition problem is considered in detail for one-parametric groups on a plane. In the case when the operators do not commutate, the recognition problem becomes more difficult. As an example the three-dimensional rotations group is considered.

**39748 (JINR—E-2-82-277) Peculiarities of N=1 supergravity with local U(1) invariance.** Galperin, A.S.; Ogievetsky, V.I.; Sokatchev, E.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701862.

The minimal N=1 supergravity with local U(1) invariance is analyzed in the framework of complex superspace. The existence of a new geometric dimensionless scalar invariant is shown. It is not present in real superspace geometry. In order to write down an action this invariant must be constrained. The constraint can be implemented in teh action by means of a Lagrange multiplier. A weakened constraint leads to an action with 16+16 fields.

**39749 (JINR—E-4-82-269) Integral representation of the one-dimensional quasiclassical wave function in a vicinity of the turning point (The airy integral generalization).** Zastavenko, L.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701868.

The integral representation of the quasiclassical wave function in a vicinity of the turning point (the Airy integral generalization) has been obtained. This representation allows one to connect the quasiclassical wave functions, as given on both sides of the turning point with any desired accuracy in the quasiclassical expansion parameter.

**39750 (JINR-D—17-81-758, pp 578-582) Application of force-force correlation functions to the problem of resistivity anomaly at high temperatures.** Schiller, W.; Langowski, G.; Ziesche, P. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). 1981. NTIS (US Sales Only), PC A25/MF A01. (CONF-8108151—).

From 2. international symposium on selected topics in statistical mechanics; Dubna, USSR (25 Aug 1981).

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Force-force correlation fUnctions are applied to the problem of resistivity anomaly at high temperatures. In order to go beyond the usual Bloch-Grueneisen law the electrical resistivity is calculated by including multiple scattering corrections via partial summations of higher order perturbation contributions of the electron-phonon interaction. For the used approximations the deviation-from-linearity effect is obtained straight-forward. The main result of the calculation is the resistivity formula containing two parameters: the Debye temperature and the interaction parameter. The numerical results are qualitatively compared with the resistivity measurements of Nb at 300 K performed in another paper.

**39751 (JINR-D—17-81-758) 2. International symposium on selected topics in statistical mechanics.** (Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. 599p. (In Russian). (CONF-8108151—). NTIS (US Sales Only), PC A25/MF A01. Order Number DE83780704.

From 2. international symposium on selected topics in statistical mechanics; Dubna, USSR (25 Aug 1981).

Abstracts of individual items from the symposium were prepared separately for the data base. (GHT)

**39752 (JINR-R—2-82-155) Covariant two-particle wave functions for model quasipotentials, permitting exact solutions. Solutions in the momentum space.** Kapshaj, V.N.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701873.

Covariant two-particle equations (namely, Logunov-Tavkhelidze equation and equation projected onto the positive energy states) are exactly solved for some model quasipotentials (among them there are quasipotentials containing the part that corresponds to repulsing at short distances) in the momentum representation. Normalization conditions and conditions of orthogonality are considered.

**39753 (JINR-R—2-82-186) Solution of the quasipotential Sturm-Liouville problems by the comparison equation method.** Gogokhiya, V.Sh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701877.

The comparison equation method (CEM) is formulated in the general form and applied to quasipotential Sturm-Liouville problem solution in the momentum representation. This method permits to obtain the solution in the form of asymptotical series in the inverse coupling constant. By two different ways of this method the discrete energy spectra at arbitrary binding energies for high partial waves are obtained. The limits of weak coupling for corresponding spectral conditions are investigated.

**39754 (JINR-R—2-82-296) Gauge principle for hyper(para) fields.** Govorkov, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701880.

The special representation of parafields due to Clifford hypernumbers is considered. The principle of the gauge invariance with respect to local hypercomplex phase transformations of parafields is formulated. It indicates the distinction of quaternionic hyperfields and the corresponding SO(3)-gauge Yang-Mills Lagrangian.

**39755 (JINR-R—2-82-330) Space-time description of events.** Strel'tsov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701881.

Conventional character of concepts of simultaneity and distance in the special relativity theory is discussed. The possibility is pointed out of introducing (within the mentioned convention) the anisotropic space-time that is characterized in general by anisotropy of velocities of physical processes. The expressions are given for one-way velocities, distances, etc. On the other hand, the possibility is discussed of time description of events in the framework of which the conditional conventions do not take place, and only direct measuring values are considered.

**39756 (JINR-R—2-82-404) Center of inertia and dipole moment relativistic operators.** Strel'tsov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1982. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701885.

In the framework of relativistic quantum mechanism covariant Hamiltonian and covariant (proper) time derivative are introduced. Operators of 4-tensor of mechanical moment and of 4-tensor of electromagnetic dipole moment closely connected, space components of which describe magnetic moment and time components - electric moments are considered. It is noted that the consequence of the existence of proper magnetic moment is the appearance of a moving particle electric dipole moment. Its absence in the proper frame of reference could be an indication in favour of the relativistic "elongation formula".

**39757 (JINR-R—5-82-193) Cauchy problem for the modified Kortweg-de Vries equation with the step-type initial data.** Zhidkov, E.P.; Kirchev, K.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701886.

In space of smooth step type functions existence, uniqueness, regularity and continuous dependence theorems for the initial value problem for the modified Korteweg-de Vries equation are established. The stability of the shape of solitary-wave solutions is proved.

**39758 (JINR-R—11-82-428) Improving difference solutions by cubic-spline-approximation of table potentials of the Schroedinger equation.** Vinitskij, S.I.; Puzynina, T.P.; Puzynin, I.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701869.

A higher accuracy of difference solutions to system of the Schroedinger equations with potentials given by tables is achieved by their extrapolation to a sequence of difference nodes. To this end the potentials are extended onto these nodes by cubic splines. The difference solution is shown to be of an order of $O(\Delta^4)$, where $\Delta$ is a step of the potential table. The theoretical estimate has been verified by numerical solution to the Schroedinger equation with the Morse potential. The improvement achieved in the energy value for some states of $\mu$-mesic molecules of hydrogen isotopes is of an order approximately $5 \times 10^{-3}$ eV.

**39759 (KFKI—1982-62) NUT-like solution with fluid matter.** Lukacs, B.; Newman, E.T.; Sparling, G.; Winicour, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Aug 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701890.

Stationary solutions of the Einstein equation are investigated when the source is a rigidly rotating fluid. Using the three-dimensional spin coefficient method the angular dependence of the metric tensor can be analytically calculated if the eigenray congruence is geodesic and shearfree. The nonstatic solutions of this class do not describe physically realistic bodies, but instead, bodies with NUT-type geometry.

**39760 (UCID—19736) Coulomb wavefunction evaluation via COULFG.** Pexton, R.L. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 13p. NTIS, PC A02/MF A01. Order Number DE83013620.

A continued-fraction method provides a foundation for evaluating Coulomb wavefunctions to high accuracy. Development of the method originated by J.W. Steed, allowable options, range of parameters, and warning of when solutions may deteriorate are discussed.

**39761 (UCRL—89182) ISPRA courses on structural dynamics-lecture notes stress rates for finite-deformation Lagrangian analysis.** Goudreau, G.L. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 23p. (CONF-830582—3). NTIS, PC A02/MF A01. Order Number DE83013037.

From Structural dynamics meeting; Ispra, Italy (16 May 1983).

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The issue of stress rates for finite deformation, which is applicable to the theory of rubber elasticity and metal plasticity, is dealt with from the viewpoint of Lagrangian analysis after a discussion of the issue's timeliness. Implementation of modern computational codes called hydrocodes is discussed. Topics covered include: Jaumann rate of Cauchy stress, rotated Cauchy stress implementation, and the example of a spinning cylinder finite rotation. (LEW)

**39762 (UWThPh—81-19) $L^2$-exponential lower bounds to excited states of quantum mechanical systems.** Hoffmann-Ostenhof, M.; Hoffmann-Ostenhof, T. (Vienna Univ. (Austria)). 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701892.

Let $H = -\Delta + V$ be defined on $L^2(Rsup(n))$, $n >= 3$. Let $V = V_1 + V_2$, $V_1$ is element of $Lsup(p)(Rsup(n))$, for some $p > 2n/3$, $V_2$ is element of $Lsup(infinity)(Rsup(n))$ and 'x'delta V/ delta'x' relatively form bounded with respect to $-\Delta$ with relative bound $< 2$. It is proven that there exists an $\alpha_0 >= 0$ such that for all $\alpha >= \alpha_0$, $esup(\alpha' x')psi(x)$ is not element of $L^2(Rsup(n))$, where psi denotes and $L^2$-eigenfunction of H. Related results are also shown to hold for many body Schroedinger operators including atoms and molecules.

**39763 Binary multiplexing and the phase-retrieval problem.** Ghiglia, D.C. (Sandia National Labs., Albuquerque). *Optics Letters;* 7: No. 12, 602-604(Dec 1982).

A binary-mask multiplexing method is developed that provides a means of recovering phase information unambiguously from measurements of the modulus of masked complex waves in the object and image planes, respectively. The technique is developed from Fourier-transform theory and combinatorial analysis and is derived for both the continuous case (optical-digital-hybrid implementation) and the totally discrete case (digital computer simulation). Computer simulations provide unambiguous recovery of phase information and indicate that the matrix equations are reasonably well conditioned for cases of practical significance.

**39764 Oscillations of Gaussian beam parameters in periodic lens waveguides.** Wenzel, R.G. (Los Alamos National Lab., NM). *Optics Communications;* 43: No. 2, 89-92(15 Sep 1982).

Gaussian beams propagating through periodic thin-lens waveguides are found to oscillate in Rayleigh range and waist longitudinal position. A differential expansion of expressions derived from Gaussian beam theory leads to approximate analytic expressions for the amplitude, period, and phase of the oscillations. The amplitude and phase are found to depend on the input parameters, while the period depends on the waveguide parameters.

**39765 Theoretical studies of ion neutralization: two-dimensional tight binding models.** McDowell, H.K. (Los Alamos National Lab., NM). *Chemical Physics (Amsterdam);* 72: 451-455(1982).

The neutralization of ions impinging on a substrate is modeled by treating the substrate as both a two-dimensional, tight-binding, semi-infinite sheet and a two-dimensional, tight-binding, infinite sheet. In both cases the equations of motion are set up in a generalized Langevin format. Results are presented for a model interaction and compared with previous computations using a semi-infinite chain model and an infinite chain model.

## 6580 Mathematical Physics

**39766 (ITEF—148(1981)) Hamiltonian structures and conservation laws of nonlinear wave equations. Poisson structures.** Lebedev, D.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 46p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701859.

Relations between two classes of two-dimensional nonlinear "integrated" differential equations and infinite-dimensional Lie algebras are described. One of these classes constitute equation of Kgphi type. The presence of the Lax representation in the algebra of differential operators with variable coefficients is their distinctive feature. The second class of the equations consists of generalized Benny moment equations. Quite special infinite-dimensional Lie algebras are used for explaining the Hamiltonian formalism of the equations of Kgphi type and Benny moment equations constructed respectively in the I. M. Gelfand, L. A. Dikoi and B. A. Kupershmidt, J. I. Manin studies on the basis of formal variational calculus. The group interpretation to Lax representations and infinite series of conservation laws in involution is presented. The invariant description of the first class of Poisson structures related to the Lax equations is obtained.

# 70 FUSION ENERGY

## 7001 Plasma Research

*REFER ALSO TO CITATION(S) 39848*

39767 **(CEA-CONF—6438) Suitable spectral line shape calculations for inertial confinement plasma diagnosis.** Lambert, D.; Louis-Jacquet, M. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Sep 1982. 23p. (CONF-820732—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701916.

From International union of pure and applied physics conference; Boulder, CO, USA (12 Jul 1982).

In plasma confinement experiments, the knowledge of the plasma state at the maximum compression time would be of utmost interest. For quite many experiments, this time can correspond to a stationary state during which the X emission conditions for a moderate Z element are maximum. Since this diagnosis mean deals with emission only, we need to get rid of reabsorption problems, since their calculation depends on the use of an ionization-excitation plasma model. That is the reason why we focus our attention onto the aspects of spectroscopic theory which control the low reabsorption line shapes - from high values of n - and more precisely the lesser reabsorbed parts of the line shapes - the wings instead of the center.

39768 (CONF-830428—, pp 40-64) **Neoclassical transport in a multiple helicity torsatron: low collisionality regime.** Shaing, K.C. (Oak Ridge National Lab., TN). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39769 (CONF-830428—, pp 65-76) **Monte Carlo transport in ATF.** Rome, J.A.; Fowler, R.H.; Lyon, J.F.; Houlberg, W.A.; Shaing, K.C. (Oak Ridge National Lab., TN). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39770 (CONF-830428—, pp 77-92) **Transport modeling: toward self-consistent determination of the radial electric field.** Houlberg, W.A.; Shaing, K.C.; Lyon, J.F. (Oak Ridge National Lab., TN). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39771 (CONF-830428—, pp 93-97) **Where are we in stellarator transport analysis.** Callen, J.D. (Univ. of Wisconsin, Madison). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39772 (CONF-830428—, pp 164-175) **Transport analysis of the proposed Heliac device HX1.** Kuo-Petravic, G.; Boozer, A. (Princeton, Univ., NJ). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39773 (CONF-830428—, pp 198-211) **Ballooning mode code in stellarators.** Berk, H.L. (Inst. for Fusion Studies, Austin, TX); Rosenbluth, M.N.; Shohet, L. Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39774 (CONF-830428—, pp 212-233) **Ballooning stability of 3-D stellarator equilibria.** Cooper, W.A. (Oak Ridge National Lab., TN). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39775 **(DOE/ER/10613—1) Extremely high-temperature-plasma research. Final report, June 1, 1980-September 30, 1982.** Marshall, T.C.; Gross, R.A. (Columbia Univ., New York (USA)). 30 Sep 1982. Contract AC02-80ER10613. 9p. NTIS, PC A02/MF A01. Order Number DE83013054.

The possibility of producing very high-temperature plasma (~ 100kV ions), using the superfast z-pinch, has been examined experimentally and theoretically. The experiment was performed using the Sandia Ripple pulsed-power device (0.2 TW, 0.25 omega, $dI/dt \sim 5 \times 10^{14}$ Amp/sec) which formed a pinch plasma in $D_2$ ($5 \times 10^{18}$ $cm^{-3}$) and Argon. Electrical and optical diagnostic data were compared with the predictions of a Hybrid code simulation (Vlasov ions + fluid electrons), taking into account the electrical characteristics of the source, as well as an MHD simulation. The MHD codes predicted higher temperature than the hybrid code, and the discrepancy increased as dI/dt increased; however, the experimental data was best modelled by the Hybrid simulation. An experiment that might be done on the Sandia 10TW Proto-II device (z = .125 omega) was simulated: 100 kV ion temperature could be achieved for a few nsec in this state-of-the-art experiment (neutron yield $\approx 2 \times 10^{10}$). We find that end losses of plasma are not significant on the experimental time scale (~ 10 - 20 nsec). The energy delivered to the diode is roughly equally divided between the plasma and the fields, but the fraction of the energy transferred to the ions increases as the power increases.

39776 **(DOE/ER/51031—T1) Two-step ECRH current-drive study. Final report.** Hamasaki, S.; Krall, N.A.; Sperling, J.L.; Guest, G.E.; Dandl, R. (JAYCOR, San Diego, CA (USA); Applied Microwave Plasma Concepts, Inc., Encinitas, CA (USA)). 8 Apr 1983. Contract AC03-82ER51031. 61p. NTIS, PC A04/MF A01. Order Number DE83012745.

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Theoretical descriptions were developed of the pump and detrapping steps of the two-step ECRH current drive that permit an identification of critical issues and an estimate of the overall figure-of-merit for this approach. The descriptions are based largely on single particle interactions with ECRH electromagnetic fields in magnetic geometries that exhibit mirror-like properties. The computations include the effects of gyrophase, velocity space pitch angle, wave amplitude, and magnetic field geometry. The calculations of the heating of the electrons in the pump step assume resonance occurs near the maximum of the magnetic field where the parallel velocity of the particles is small, while the detrapping process was evaluated near the minimum field at the bottom of the magnetic well where the parallel velocity of the trapped particles is large. Several alternative approaches for heating the electrons to collisionless energies in the pump step were evaluated.

39777 **(DOE/ER/52076—5) EPFL (Swiss) Fusion-Fission Hybrid Experiment. Progress report No. 5, November 1, 1982-February 15, 1983.** Woodruff, G.L.; Sitaraman, S. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). 1 Mar 1983. Contract AT06-82ER52076. 27p. NTIS, PC A03/MF A01. Order Number DE83013492.

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The present phase of work involves replacing the complicated Haefely source with a simple equivalent surface source model in

the computer simulation of the LOTUS experiments. The basic idea behind this is that, if the neutron source in the MCNP code could be set up so that the neutrons start out on the outer surface of the tube with the correct spatial, energy and angular distributions, a lot of computing time is saved. This is primarily so because the neutrons do not have to be repeatedly transported from the target, through the tube, to its outer surface.

**39778 (DOE/ET/51013—83) Ray-tracing analysis of electron-cyclotron-resonance heating in straight stellarators.** Kato, K. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). May 1983. Contract AC02-78ET51013. 128p. (PFC/RR—83-13). NTIS, PC A07/MF A01. Order Number DE83013854.

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A ray-tracing computer code is developed and implemented to simulate electron cyclotron resonance heating (ECRH) in stellarators. A straight stellarator model is developed to simulate the confinement geometry. Following a review of ECRH, a cold plasma model is used to define the dispersion relation. To calculate the wave power deposition, a finite temperature damping approximation is used. 3-D ray equations in cylindrical coordinates are derived and put into suitable forms for computation. The three computer codes, MAC, HERA, and GROUT, developed for this research, are described next. ECRH simulation is then carried out for three models including Heliotron E and Wendelstein VII A. Investigated aspects include launching position and mode scan, frequency detuning, helical effects, start-up, and toroidal effects. Results indicate: (1) an elliptical waveguide radiation pattern, with its long axis oriented half-way between the toroidal axis and the saddle point line, is more efficient than a circular one; and (2) mid-plane, high field side launch is favored for both O- and X-waves.

**39779 (DOE/ET/52040—T9) QLD1: quasi-linear diffusion of the thermonuclear-driven fast magnetosonic instability.** Sutton, W.R. III. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). Jun 1982. Contract AC02-76ET52040. 91p. (COO—2218-251). NTIS, PC A05/MF A01. Order Number DE83013392.

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A user's manual for the code packages QLD1 and ETAT is described. ETAT surveys the n/sub e/-T/sub i/ plane for candidate instability regions for the fusion product driven fast magnetosonic wave, omega $\simeq$ L $\Omega$/sub a/ = k/sub perpendicular to/v/sub A/. Threshold contours are plotted for a given toroidal magnetic field, radial position and wave frequency. OLD1 numerically solves the 1-D (v/sub parallel/-averaged) quasi-linear diffusion of the birth, 3.5 MeV alpha distribution function. It is shown elsewhere that the complete 2-D quasi-linear problem can be rigorously reduced to 1-D. Plasma level consequences of this instability are quantified in terms of an enhanced heating rate to plasma ions. Both ETAT and QLD1 have options to replace the isotropic alpha source with a perpendicularly injected neutral beam having a Gaussian energy spread of arbitrary width. When integrated with the 1 1/2-D tokamak transport code WHIST, system level response to the instability can be studied.

**39780 (DOE/ET/53036—39) Spectrum of compressional Alfven waves.** Mahajan, S.M.; Ross, D.W. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1982. Contract AC05-76ET53036. 19p. NTIS, PC A02/MF A01. Order Number DE83005632.

The spectrum of compressional Alfven eigenmodes localized in the potential well created by a combination of the variation in plasma density and the wave number k/sub perpendicular to/ = m/r, is obtained, and its importance for ratio frequency current drive is discussed. It is found that modes with small parallel wave numbers and frequencies below the ion cyclotron frequency are attractive for current drive.

**39781 (DOE/ET/53051—54) Stability analysis of experimental high-beta toroidal plasmas.** Kellman, A.G.; Phillips, M.W.; Prager, S.C.; Zarnstorff, M.C. (Wisconsin Univ., Madison (USA)). Jun 1983. Contract AC02-76ET53051. 48p. NTIS, PC A03/MF A01. Order Number DE83013543.

We have previously reported the production of stable high-beta plasmas in the University of Wisconsin Levitated Toroidal Octupole. The plasma beta measured in the bad-curvature region ranges from $\beta \sim 8\%$ to 44% (n/sub e/ $\sim$ 2-5x10$^{13}$ cm$^{-3}$, B/sub pol/ $\sim$ 200 to 860 G) in macroscopically stable plasmas with decay times in excess of 1000 Alfven times. We describe theoretical work performed on non-MHD effects to explain the significant enhancement of plasma stability above the ideal MHD ballooning instability limit of 4%. The effects are included in finite-n MHD theory and a detailed kinetic treatment including finite Larmor radius and heat flow along field lines. The FLR effects are sufficient to explain the stability of the $\beta = 8\%$ plasma through coupling of the ballooning mode to a stable oscillatory ion drift wave. This cannot explain the stability of the more-collisional, larger gyroradius $\beta = 44\%$ plasma. Equilibrium diamagnetism is strongly affected by ion gyroviscosity in this plasma, and the role of this effect on the equilibrium and stability is discussed.

**39782 (DOE/ET/53051—55) Ion-cyclotron-resonance heating in the Wisconsin Levitated Octupole.** Fortgang, C.M.; Sprott, J.C.; Strait, E.J. (Wisconsin Univ., Madison (USA). Dept. of Physics). Jun 1983. Contract AC02-76ET53051. 33p. NTIS, PC A03/MF A01. Order Number DE83013532.

Ion-cyclotron-resonance heating has been investigated, both experimentally and theoretically, on the Wisconsin Levitated Octupole. Heating of both ions and electrons has been observed. Typically, a two-component ion energy distribution is produced (300 eV and 50 eV) with 500 kW of rf power coupled into a 5 x 10$^{13}$ cm$^{-3}$ plasma. Power is coupled to the plasma with an antenna that also serves as the inductor of an oscillator tank circuit. The oscillator is tunable from 1 to 3 MHz and can be applied for periods up to 10 msec. The experiments were performed with hydrogen, gun-injected plasmas. Most of the theortical work presented deals with a calculation that predicts the plasma loading. A slab model is used, and the questions of accessibility, polarization, and damping of the radio-frequency electromagnetic fields are addressed. It is found that cold-plasma theory cannot account for the heating and, therefore, hot-plasma theory is invoked to explain the results. The loading measurements and theoretical predictions are found to be in reasonable agreement.

**39783 (DOE/ET/53088—67) Guiding-center dispersion function.** Similon, P.; Sedlak, J.; Stotler, D.; Berk, H.L.; Horton, W. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Dec 1982. Contract FG05-80ET53088. 29p. (IFSR—67). NTIS, PC A03/MF A01. Order Number DE83005667.

Analytical properties of the linear Vlasov response function for guiding center particle motion in low frequency flute modes are investigated for a two temperature Maxwell-Boltzmann plasma. Algorithms are given for evaluating the family of analytic functions G/sub m,n/($\omega$) along with the software implementing the methods and user documentation on MFE files.

**39784 (EUR-CEA-FC—1130) Lectures on resistive instabilities in MHD.** Paris, R.B. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Feb 1982. 89p. (CONF-8008166—1). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83701656.

From Workshop on hydrodynamics of stellar atomospheres; Meudon, France (18 Aug 1980).

The discussion of resistive instabilities in MHD is approached by first considering the ideal gravitational interchange instability in an infinitely conducting plasma slab. It is shown that in an ideal plasma slab of non-uniform density confined by a magnetic field, the value of the gravitational acceleration (acting in the direction of decreasing density) has to exceed a certain finite value -the Suydam criterion- for the onset of the interchange mode. The introduction of finite resistivity in situations which would be stable according to the Suydam criterion in ideal MHD, results in a more slowly growing instability known as the resistive G-mode. The consideration of this mode in the simple case of a uniform magnetic field forms the basis for the subsequent discussion of resistive instabilities in a plane current layer with a non-uniform magnetic field -

the resistive G-mode, the "rippling" mode arising from an equilibrium resistivity gradient and the "tearing" mode driven by a non-uniform current density. An alternative discussion of the G-mode is given utilising the so-called "quasi-mode" formulation.

39785 **(EUR-CEA-FC—1141) Toroidal and nonlinear effects on propagation and conversion of low frequency EM wave in a full toroidal hot plasma.** Cotsaftis, Michel. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Sep 1982. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701917.

Due to its important consequences in a precise determination of the power deposition profiles in a Tokamak, the problem of the propagation of a low frequency EM wave has been reconsidered in taking account consistently of the geometry -i.e. the full toroidal structure of the static magnetic field- and of the physics of a hot plasma medium. It is mainly shown that for an EM wave launched from the high field side, the somewhat idealized plane slab analysis of the wave conversion phenomenon is not strictly applicable. In fact, due to the toroidal structure of the field, there exists a critical radius, in general small= -rsub(int) approximately= a/4 - above which the electrostatic component, which is created when reaching the ion-ion hybrid layer, is not reflected backward like in the conversion process, but propagates with the EM wave. In this case, there is much more a modification of the original EM wave, and, at the same time, the wave vector of this wave is shown to increase largely when getting further away from the ion-ion hybrid layer. Because of this modification, the wavelength can become of the order or smaller than the ion larmor radius at some radius rsub(lim). Now, if Landau cyclotron absorption is strong enough before reaching this radius, there is the usual ion heating, and this occurs for a location of the ion cyclotron resonance layer close enough to the ion-ion hydrid layer, i.e. for a ratio of the ion densities nsub(H)/nsub(D) less than a limiting value. But when nsub(H)/nsub(D) highly exceeds this value, the wave propagates until rsub(lim) is reached, and interacts with the particles in a stochastic way. For large enough power input, this leads to a new kind of heating which has been experimentally observed, in agreement with the theoretical predictions.

39786 **(EUR-CEA-FC—1148) Effect of energy deposition and thermoelectric transport coefficients on energy balance.** Capes, H.; Mercier, C. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Mar 1982. 26p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701657.

Two states of a deuterium plasma are compared, with and without the injection of neutral particles. The effects of impurities on the interpretation of the energy balance is discussed, and the effect of the transport model is outlined.

39787 **(EUR-CEA-FC—1149) Ion cyclotron-resonance heating in the TFR Tokamak.** Lapierre, Y. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee; Paris-11 Univ., 91 - Orsay (France)). Jun 1982. 246p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83701658.

The propagation of waves in Tokamak configurations is analyzed experimentally. Various diagnostic methods are employed. The antenna coupling resistance, magnetic loop measurements and a coherent scattering experiment with a 10.6μm ($CO_2$) laser beam are discussed. The results of heating experiments at high powers are given in the next chapter. The complexity of Tokomak discharges necessitates the use of a whole variety of diagnostic techniques ranging from ultraviolet spectroscopy and microwave interferometry to neutron detection. The results obtained from various experiments giving information about specific areas in the field of heating are grouped together. The isotopic composition of the plasma is demonstrated together with the way in which an electromagnetic wave can be used for direct heating of the electrons in plasmas. Examples of complete energy balances in discharges with additional heating are given.

39788 **(EUR-CEA-FC—1153) Internal disruptions in Tokamak: a turbulent interpretation.** Dubois, M.A.; Pecquet, A.L.; Reverdin, C. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jul 1982. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701918.

High speed X-ray data of sawteeth in TFR are interpreted using a kinematic model. It is shown that the internal disruption begins for a small size of the q = 1 island, and that the sharp details observed on different chords are not reproduced by a total reconnection model. Conversely they are well simulated by a model where the temperature flattening is due to the propagation of a turbulent region starting from the q = 1 surface.

39789 **(EUR-CEA-FC—1154) Inertial and viscous effects in the non linear growth of the tearing mode.** Edery, D.; Frey, M.; Tagger, M.; Soule, J.L.; Pellat, R.; Bussac, M.N.; Somon, J.P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Aug 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701919.

The non linear self similar Tearing mode solution of Rutherford is revisited. We compute explicitly the stream function for the plasma flow including inertia, convection and viscosity. In all cases, Rutherford's solution is asymptotically valid.

39790 **(EUR-CEA-FC—1157) Equivalent methods for quasi-linear turbulent trajectories.** Misguich, J.H.; Tchen, C.M. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jun 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701920.

The propagator formalism is summarized in a self-consistent way for the asymptotic quasi-linear equation. A comparison is performed between the propagators and the Green's functions in the case of the non-asymptotic quasi-linear equation. This allows to prove the equivalence of both kind of approximations used to describe perturbed trajectories of plasma turbulence.

39791 **(EUR-CEA-FC—1158) New kinetic description for turbulent collisions including mode-coupling.** Misguich, J.H.; Tchen, C.M. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Jul 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701921.

The usual introduction of higher-order mode-coupling terms in the description of turbulent collisions beyond usual Renormalized Quasi-Linear approximation (RQL) is briefly analyzed. Here new results are derived in the framework of the general kinetic theory, and the equivalence is proved with the long time limit of simple results deduced from the Vlasov equation. The correction to the RQL turbulent collision term is analyzed and a new approximation is proposed. Turbulent collisions are also described by perturbation around the Lagrangian autocorrelation of fluctuating fields. For an homogeneous turbulence, however, the asymptotic integral of this Lagrangian autocorrelation vanishes identically, similarly to what occurs in Brownian motion. For inhomogeneous turbulence this method can nevertheless be used, and higher-order mode-coupling terms can be interpreted as a shielding of elementary Lagrangian turbulent collisions.

39792 **(EUR-CEA-FC—1160) Heavy impurity transport in the TFR tokamak. Comparison of line emission with numerical simulations.** (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Oct 1982. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701922.

Heavy element ion line emissions have been simulated with a numerical code using two adjustable, independent of radius, parameters in the flux density expression: an anomalous diffusion coeffi-

cient Dsub(A) and an inward convective velocity Vsub(A). Previously reported results on the laser blow-off injection of V, Cr, and Ni have thus been interpreted. The quasi-stationary phase of ohmically-heated high-density (nsub(e)(0)approximately$1.5x10^{14}$ $cm^{-3}$) discharges has also been simulated, thus allowing the plasma "chemical" composition and the radiated power to be calculated.

**39793 (EUR-CEA-FC—1161) Saturation regime of the collisionless drift instability in a hydrogen plasma column.** Boissier, R. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). Sep 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701923.

The saturation regime of the collisionless drift instability is observed in a steady state hydrogen column. The steady state parameters are observed to relax around the average values. A quasilinear model is proposed to describe the dynamics of wave growth and density gradient decay.

**39794 (GA-A—17031) Hardware and software configuration of the Doublet III diagnostic-data-acquisition computer system.** McHarg, B.B. Jr. (GA Technologies, Inc., San Diego, CA (USA)). May 1983. Contract AC02-76ET51001. 84p. NTIS, PC A05/MF A01. Order Number DE83013427.

The Doublet III data-acquisition computer system acquires, archives, and processes over 3 megabytes (mb) of data from each shot of the experiment. A shot lasts 1 to 2 s and occurs every 5 to 6 min with 50 to 100 shots/day. The data acquisition system has been configured to efficiently handle the increasing quantity of data as new diagnostics are added (5 mb within a year) and to provide interactive capability during operations. The computer tasks that accomplish this acquisition begin execution immediately on reboot of the computer system and continue throughout the preacquisition stage before a shot, the actual acquisition stage when the shot is fired, and the postacquisition, or analysis, stage. This document is a guide to the hardware and software configuration of the Doublet III data-acquisition system and discusses the interaction of the computer tasks with each other as well as with database files, data files, and global tables. Detailed descriptions of these files and tables are given.

**39795 (IAE—3452/7) Plasma filament equilibrium in the TO-2 racetrack tokamak.** Melikhov, P.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 28p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701924.

Some plasma filament equilibrium problems in the TO-2 racetrack tokamak are considered. The paper is of practical character, so all calculations have finite numerical results and concrete recommendations. Measurement procedures are presented. Calculations and measurements on the model allowed to choose correction and control winding geometry and determine their parameters. The vortical winding location on the magnetic circuit is determined. Real configuration of the device magnetic circuit is taken account of. Disregard of magnetic circuit effect on plasma filament equilibrium is the cause of considerable mistakes and is found to be inadmissible.

**39796 (IAE—3464/7) Optical studies of light impurities and transport processes in the plasma periphery region in the T-10 device.** Gegechkori, N.M.; Zhidkov, A.G.; Pimenov, A.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 36p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701925.

At the T-10 device by means of the optical system consisting of the MDR-2 monochromator and mirror sean space-time distributions of radiation intensity of deuterium lines and a number of light impurity ions in absolute units have been studied. Basic observations have been concentrated on the investigation of radiation intensity distribution over the vertical diameter of T-10 device of the following lines: Dsub($\beta$) (4860 A), C5 (2271 A), C3 (2296 A), C3 (4647 A) and O5 (2871 A). The theoretical calculation of excitation functions performed permits to find the dependence of relative intensity of C3 lines on electron temperature in the T-10 bench mark regime on the radius of the mobile diaphragm (asub(L)=29 cm), evaluated by relative intensity of C3 lines constitutes 30+-10 eV. The method of evaluation of light impurity full concentration through the highly ionized ions removal velocity determined by observation radius and lifetime of charged particles is proposed. In the internal wing region of radial distribution of C5 line intensity full carbon concentration evaluated through the local lifetime constitutes approximately (2-3)$x10^{11}$ $cm^{-3}$ or approximately 1% and through the integral one-(7-8)$x10^{11}$ $cm^{-3}$ or 4%.

**39797 (IAE—3479/6) Equation of ion quasilinear diffusion in an adiabatic trap at drift-cone instability.** Timofeev, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701926.

Drift-cone instability is an obstacle when creating thermonuclear reactor based on an open magnetic trap. Additional plasma losses due to instability development may be calculated by quasilinear diffusion equation. The paper is aimed at consequent derivation of quasilinear diffusion equation as well as obtaining of a number of simplified expressions for quasilinear diffusion coefficient. Equation of ion quasilinear diffusion in an adiabatic trap at oscillation frequency close to ion cyclotron one is obtained. Accurate diffusion coefficient value is compared with approximate values received at different approximations.

**39798 (IAE—3495/6) Transverse electron losses in magneto-electrostatik traps with low plasma density.** Il'gisonis, V.I.; Pastukhov, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701927.

Main mechanisms of electron drift across magnetic field in magneto-electrostatic traps taking into account the peculiarities of modern experimental devices are considered. Much attention is paid to two types of magnetic configurations used at present. Expressions for plasma life time corresponding to classical and anomalous electron drift mechanisms are obtained. The effect of the above mentioned mechanisms on ion behaviour as well as on density distribution and electric field distribution in plasma is analysed.

**39799 (IAE—3499/6) Longitudinal energy and mass losses when theta-pinch radial compression.** Gryukanov, M.F.; Konkashbaev, I.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 39p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701928.

Self-simulating solutions of the problem on energy and plasma losses in the compression process by theta-pinch liner with closed faces are obtained. The analysis of dynamics of development of self-simulating temperature and density disturbances for theta-pinch radial compression and central-symmetric plasma compression by the shell is performed. In the first case the problem has been reduced to the one-dimensional one under the assumption of uniformity of initial density and temperature distribution along the radial and angular coordinate while in the second case naturally a distribution uniformity relative to angular coordinates has been assumed. It follows from the analysis in the system cooling and heating waves may propagate with increasing as well as decreasing amplitude depending on the problem parameters: initial mass of heated plasma, typical times of radiation cooling and compression ratio and adiabat factor.

**39800 (IAE—3505/6) Analytical theory of the tokamak ideal ballooning mode induced by shear.** Mikhajlovskij, A.B.; Yurchenko, Eh.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701929.

Analytical theory of effects connected to finite pressure in ideal ballooning mode induced by shear is given. A new method allowing to take account of the members of the fourth order by plasma pressure is worked out. Stability criteria describing the second stability zone are obtained.

39801 **(IAE—3512/6) Loss of injected hot ions due to multiple charge exchange in a tokamak.** Dnestrovskij, Yu.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701930.

A model of energy transfer from hot ions to plasma particles with account for the possibility of multiple charge exchanges of hot particles is constructed. In the general case the equation describing the energy transfer process turns to be integrodifferential. In the case of large optical thickness the kinetic equation is reduced to the equation of a diffusion type, containing the first derivative over velocity and the second - over space coordinate. The qualitative analysis of the diffusion equation solution allows one to find maximum neutral beam power which can be assimilated by the plasma. For the T-11 device nowadays experiments at the level approximately 600 kWt approximately correspond to maximum admissible power. For the 1 S X-B the injected power (approximately 2 MW) is higher than the maximum admissible for the present discharge conditions. This must lead to fast hot ions removal on the wall. The maximum admissible power value grows quickly with the increase of the dimension of the device ( approximately $\alpha^4 R$) and plasma density (approximately $n^4$) therefore multiple charge exchange is not essential in large tokamaks of INTOR.

39802 **(IAE—3514/4) Zet-pinch parameter optimization on the base of neutron emission.** Ananin, S.I.; Vikhrev, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701931.

The paper concerns a simplified Z-pinch compression model, describing the stages of pinch shell motion and the compression plasma column. Z-pinch optimization is conducted on the base of thermonuclear neutron emission. It is shown that the model gives correct and optimal values of pinch radius, its height, the external inductance of a circuit, and also the value of neutron emission at the optimal discharge parameters. Presented are the interpolation formulas for the optimal values, obtained as a result of simulation. From the results obtained it follows that to increase the neutron emission it is necessary to increase the pressure of working fluid in Z-pinch chamber.

39803 **(ITEF—54(1982)) Recombination processes effect on multicharged ion yield from a laser plasma.** Latyshev, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 36p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701932.

Ionization processes in a plasma heated by focused laser radiation are considered. Main attention is given to the case of multicharged plasma of heavy elemens with atomic weight A approximately 100, typical ion charging Z approximately 10-20, electron temperature. THETAsub(t) approximately $10^2$-$10^3$ eV and electron density of critical order. It is shown that dielectron recombination exerts strong influence on multicharged ion parameters. Prospects of using gaseous target and $CO_2$ lasers for creation of multicharged ion source based on a laser plasma is noted.

39804 **(JEN—519) Spectroscopic system for impurity measurements in the TJ-1 tokamak of JEN.** Zurro, B.; Navas, G. (Junta de Energia Nuclear, Madrid (Spain)). 1982. 75p. (In Spanish). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83701659.

Paper copy only, copy does not permit microfiche production2 figs.; 23 refs.

A spectroscopic system with spatial resolution capability is described. It has been configured for plasma diagnostic in the TJ-1 tokamak of JEN. The experimental system, based on a one meter monocromator, has been absolutely calibrated using a tungsten-halogen lamp. The calibration procedures and the absolute spectral sensitivity are presented as well as its dependence with the polarization. A simplified spectroscopic model of the radiation emitted by the intrinsic plasma impurities (C, O, ...) has been developed. A one dimensional model of the temporal evolution of various ionization stages in coronal equilibrium is used to predict the electron temperature and impurity concentration. This model has been applied to experimental data from several tokamaks.

39805 **(KFKI—1982-76) Anomalous periodic disruptions in tokamak plasma.** Montvai, A.; Tegze, M.; Valyi, I. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701661.

8 refs.

Anomalously strong, periodic instabilities were observed in the MT-1 tokamak. Characteristics of these instabilities were partly similar to those of internal disruptions, but there were features making them different from the normal relaxational oscillations. Basic characteristics of the phenomenon were studied with the aid of generally used diagnostics.

39806 **(LRP—196/81) Discrete Alfven-wave excitation as a tokamak plasma diagnostic.** Joye, B.; Lietti, A.; Lister, J.B.; Pochelon, A. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland); Ecole Polytechnique Federale, Lausanne (Switzerland)). 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83902390.

Results obtained on the TCA tokamak have shown that there are narrow peaks in the absorption of rf power at omega < omega/sub ci/ which occur near the threshold of the Alfven continuum. Their use as a diagnostic for measuring the mass density and safety factor on the axis of a tokamak discharge is proposed. The application of this method to tokamak plasmas in TCA is discussed.

39807 **(NIIEFA-P-B—0551) Regularization method application to the equilibrium system of a tokamak-reactor at given configuration of a plasma filament.** Filatov, O.G. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701936.

Portions are illegible in microfiche products8 refs.; 2 figs.; 2 tabs.

The problem of the reactor-tokamak equilibrium system calculation at given configuration of a plasma filament is considered. For its solution the regularization method is applied. The regularization parameters are so selected that the problem solution can be compared for accuracy with the initial data, determined by plasma parameters. The technique permits to directly determine currents in the coils of this system necessary for retaining in equilibrium the plasma filament with the specified parameters and configuration with regard to uncertainty of initial data. The stability of the obtained solution is ensured in a usual methematical sense as well as in the sense of low sensitivity to the uncertainties of the initial physical data.

39808 **(NIIEFA-P-K—0524) Numerical simulation of a linear theta pinch with a strong fast increasing magnetic field.** Burtsev, V.A.; Kozhevin, V.M. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. 23p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701938.

Portions are illegible in microfiche products1 refs.; 9 figs.; 1 tab.

The modified model of the "snow plough" for the analysis of plasma dynamics in the fast compression phase with account for field diffusion and entropy variation of the plasma is described. The calculations carried out using the MHD-model taking into account the processes of classical and anomalous transport have shown that the constructed modified "snow plough" model satisfactorily describes the behaviour of main parameters characterizing theta-pinch dynamics. On the basis of the last model it is obtained that the increase of plasma turbulence power sharply decreases radial com-

pression, however the total energy remains almost constant. Approximate analytical solutions are obtained which are in satisfactory agreement with the numerical calculation results and permit to forecast the evolution of temperature, magnetic field and radius of the plasma filament. The efficiency of time decrease of magnetic field growing for increase of energy contribution into plasma has been shown.

39809 **(NIIEFA-P-K—0525) Study on the effect of plasma turbulence and inhomogeneity on coherent sounding radiation propagation in a linear theta pinch with a strong fast increasing magnetic field.** Berezin, A.B.; Burtsev, V.A.; Kozhevin, V.M.; Smirnov, A.G.; Smirnov, V.G. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701939.

Portions are illegible in microfiche products5 refs.; 2 figs.

Possibilities of emergence of fast electron density changes caused by the development of turbulent processes in plasma and formation of plasma jets at axially inhomogeneous plasma compression are analytically considered. It is shown that the previously observed experimentally effect of the coherence loss of the sounding radiation can be explained by the emergence of the low-hybrid drift instability. Besides the widening of sounding radiation line and substantial increase of its divergence may be caused by formation of cumulative jets at axially-inhomogeneous plasma compression.

39810 **(NIIEFA-P-K—0543) To the problem of fast electron production in a linear theta pinch without reverse magnetic field.** Bardinov, A.A.; Burtsev, V.A.; Kozhevin, V.M.; Lyublin, B.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701940.

Portions are illegible in microfiche products0 refs.; 5 figs.; 1 tab.

The results of conducted experimental and theoretical investigations of the processes of overthermal electron production in dense plasma of the fast linear theta-pinch without reverse initial magnetic field are reported. As a result of experimental investigations at the "UTRO" device the presence of hard overthermal X ray radiation in the maximum plasma compression phase has been found out. The typical energy spatial distribution in the radiation spectrum is obtained. It is shown that the most probable under the conditions of the given experiment microturbulences cannot lead to the production of fast electrons responsible for the observed radiation. The axially-non uniform plasma compression model is proposed in the framework of which a principle possibility of emergence of high energy electron bundles accelerating at overclosing of magnetic force lines.

39811 **(NIIEFA-P-K—0557) Laser scattering technique application for fast linear theta-pinch plasma diagnostics.** Bardinov, A.A.; Burtsev, V.A.; Kubasov, V.A.; Lyublin, B.V.; Litunovskij, V.N. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701941.

8 refs.; 5 figs.

Laser scattering technique application for investigating dense theta-pinch plasma with fast increase magnetic field is reported. The description of the apparatus providing the possibility to simultaneously register scattered radiation under narrow and wide angles is given. Light outlet is performed directly through the quartz chamber walls by means of fibre light pipes. Local values of electron concentration and temperature (nsub(e)=5x10sup(16) $cm^{-3}$, Tsub(e)=86sub(-3)sup(+9) eV) in the near-axis charge zone at the stage of fast increase of magnetic field are measured. The nsub(e) and Tsub(e) values obtained are in a satisfactory agreement with the theoretical data. The performed experiments have shown wide possibilities of apparatus complex for plasma diagnostics in linear systems.

39812 **(PPPL—2005) Overview on collision processes of highly charged ions with atoms present status and problems.** Janev, R.K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1983. Contract AC02-76CH03073. 19p. NTIS, PC A02/MF A01. Order Number DE83013723.

This paper provides a brief discussion on the present status of the collision physics of highly charged ions with atoms. The emphasis is on the main achievements in understanding and describing the most important collision processes, and as charge transfer, ionization and Auger-type processes, and even more on those open problems which, due either to their scientific or practical importance, represent challenges to current research in this field. The paper concentrates on general ideas and problems whose development and solutions have advanced or will advance our basic understanding of the collision dynamics of multiply charged ions with atoms.

39813 **(PPPL—2006) Plasma-equilibrium calculations by line successive over relaxation.** Redi, M.H.; Larrabee, D.A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). May 1983. Contract AC02-76CH03073. 13p. NTIS, PC A02/MF A01. Order Number DE83013718.

Line successive over relaxation (LSOR) is an iterative method for solving elliptic differential equations. LSOR takes advantage of the CRAY vector capabilities as compared to the point successive over relaxation (SOR) method, which does not vectorize. The substantial advantages of LSOR on a vectorizing machine are not well-known, except in the field of aerodynamics. By minor modification of the traditional SOR elliptic equation solver, we find that in certain coordinates an increase of a factor of two or greater in convergence time can be realized. As a model problem for comparison of SOR and LSOR, the numerical solution of Poisson's equation will be reviewed in Sec. II. In Sec. III, we discuss the decreased computation time on the National Fusion Energy Computer Center (NMFECC) CRAY computers found with LSOR applied to the iterative solution of plasma equilibria. In Sec. IV, the conditions for which LSOR is most useful are summarized.

39814 **(PPPL—2010) X-ray analysis of nonMaxwellian distributions (current drive).** von Goeler, S.; Stevens, J.; Stodiek, W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1983. Contract AC02-76CH03073. 50p. (CONF-820944—9). NTIS, PC A03/MF A01. Order Number DE83013722.

From Workshop on diagnostics for fusion reactor conditions (International school of plasma physics); Varenna, Italy (6 Sep 1982).

The plasma bremsstrahlung emission is utilized to determine the shape of the electron velocity distribution in situations where it deviates strongly from a Maxwellian distribution. The instrumentation used to measure the hard x-ray emission is briefly discussed. Model calculations show that polarization measurements give best results for unrelativistic tails with tail temperatures T/sub b/ $<$ 50 keV, whereas measurements of the angular distribution of the x-ray emission based on the forward scattering of bremsstrahlung for relativistic electrons yields the best information for T/sub b/ $>$ 50 keV. The techniques were originally developed in order to analyze runaway discharges. Recently, they found new interest because of the formation of energetic electron tails during current drive. The first x-ray results from the current drive during LH heating on PLT are discussed.

39815 **(PPPL—2012) Determination of the electron velocity distribution from the soft and hard x-ray emission during lower-hybrid current drive on PLT.** von Goeler, S.; Stevens, J.; Karney, C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jun 1983. Contract AC02-76CH03073. 25p. (CONF-830210—19). NTIS, PC A02/MF A01. Order Number DE83013720.

From 5. topical conference on radio frequency plasma heating; Madison, WI, USA (21 Feb 1983).

During lower-hybrid heating in low-density-tokamak discharges, a nonMaxwellian tail of high-energy electrons is formed. This tail carries the plasma current. Utilizing the fact that relativistic electrons emit bremsstrahlung predominantly in the forward di-

rection, we investigate the shape of the electron distribution by measuring the dependence of the x-ray emission on the angle between the magnetic field and the line of sight. The experimental data indicate that the distribution function is predominantly peaked in the forward direction, although a small fraction of the electrons is in the backward cone. The energy dependence of the x-ray spectra is consistent with that of a velocity distribution which has a plateau extending out to several hundred kiloelectron volts. Radial profiles show that the hot electrons are located in the central plasma region and form a high-conductivity plasma with the current profile frozen in. The slope of the spectrum depends on the rf power and on the phasing of the waveguide grill, but not on the externally applied plasma voltage. Relaxation oscillations occur shortly after switching the rf off. They also appear during the rf for low rf power and at the high-density limit of the lower-hybrid current drive. The x-ray spectra confirm that parallel energy is transferred to perpendicular energy during the instability, suggesting an instability due to the anomalous Doppler effect.

39816 **(SAND—83-1341C) Instabilities in cylindrical plasma liners imploded by high magnetic fields.** Hussey, T.W. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 15p. (CONF-830606—10). NTIS, PC A02/MF A01. Order Number DE83013640.

From 3. international conference on magagauss magnetic field generation and related topics; Novosibirsk, USSR (13 Jun 1983).

It has been predicted theoretically and demonstrated experimentally that the hydromagnetic Rayleigh-Taylor instability is present in some devices in which plasma cylinders are imploded by high current. It has also been observed that this instability is less damaging for implosions of cylindrical gas puffs than for implosions of cylindrical foils. In this presentation we show that this instability is different for foils, which correspond to thin shells of high aspect ratio, than it is for gas puffs, which have a very low aspect ratio. We, furthermore, relate this to recent work in which the effects of the Rayleigh-Taylor instability in thin foils are related to load design parameters. We find that the improved stability of gas puffs allow larger radius implosions with higher implosion velocities. Finally, we show that a hybrid system with a uniform density gas inside a cylindrical foil offers much of the stability of gas puffs together with the uniformity and low inductance of a foil system.

39817 **(UCID—19759) Radial space potential measurements in the central cell of the tandem mirror experiment with a heavy-ion-beam probe.** Hallock, G.A. (Lawrence Livermore National Lab., CA (USA)). 11 Apr 1983. Contract W-7405-ENG-48. 275p. NTIS, PC A12/MF A01. Order Number DE83013284.

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Spatial and temporal profiles of the space potential in the central-cell midplane of TMX have been obtained with a heavy-ion-beam probe. The absolute accuracy of measurements is +- 25 volts (with respect to the machine vacuum walls) with a resolution of ~ 2 volts. During moderate fueling with the gas boxes (i/sub gas/ ≅ 1200 Atom-Amperes $D_2$), the plasma potential is parabolic to at least 25 cm radius, with phi/sub e/ ≅ phi/sub max/[1-(r/32)$^2$] and 300 < phi/sub max/ <450 volts. With puffer-valve fueling, the space potential is relatively flat to at least 27 cm radius, with 250 < phi/sub e/ < 350 volts.

39818 **(UCRL—89276) ECRH in tandem mirror machines.** Stallard, B.W. (Lawrence Livermore National Lab., CA (USA)). 27 May 1983. Contract W-7405-ENG-48. 49p. (CONF-830594—1). NTIS, PC A03/MF A01. Order Number DE83013378.

From IEEE minicourse on RF heating and current drive; San Diego, CA, USA (24 May 1983).

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The thermal barrier concept and the use of ECRH to generate the several electron populations required to establish confinement are discussed. Important physics issues related to the microwave heating are discussed. Fokker-Planck calculations which model the heating processes are presented, followed by recent experimental data on hot electron heating.

39819 **Beta and confinement scaling studies with neutral-beam heating in the ISX-B tokamak.** Neilson, G.H.; Lazarus, E.A.; Murakami, M. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion;* **23**: No. 3, 285-294(Mar 1983).

Experiments to investigate the scaling of volume-averaged beta $<\beta>$ and a global energy confinement time tausub(E)* for neutral-beam-heated (Psub(b) <= 2.5 MW) discharges in the ISX-B tokamak are described. The results are condensed into a set of empirical scaling formulas which can be used as a guide for other theoretical and experimental studies of confinement in high-beta, neutral-beam-heated plasmas. The dependence on toroidal field Bsub(T), plasma current Isub(P), and line-averaged electron density n-barsub(e) was determined by varying each of these while keeping other external variables fixed. Magnetic diagnostics were used to obtain global properties, and Thomson-scattering-based profile analysis was carried out to permit more detailed investigation of selected cases. The poloidal beta, $\beta$sub(p), is found to be independent of Bsub(T) and n-barsub(e) at fixed beam power Psub(b); confinement is found to deteriorate with increasing Psub(b) but to improve with Isub(P), consistent with previous results. The mechanisms which govern this confinement scaling have not been discerned, but it apparently does not depend on $<\beta>$, Bsub(T), or the (m = 1; n = 1) MHD activity, which typically dominates the MHD diagnostic signals. Losses are primarily through the electron channel, and the scaling of electron energy confinement time is similar to that of tausub(E)*.

39820 **Equilibrium poloidal-field distributions in reversed-field-pinch toroidal discharges.** Baker, D.A.; Mann, L.W.; Schoenberg, K.F. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* **23**: No. 3, 380-383(Mar 1983).

Letter-to-the-editor.

A comparison between the approximate analytic formulae of Shafranov for equilibrium in axisymmetric toroidal systems and fully toroidal numerical solutions of the Grad-Shafranov equation for reversed-field-pinch (RFP) configurations is presented as a function of poloidal beta, internal plasma inductance, and aspect ratio. The Shafranov formula for the equilibrium poloidal-field distribution at the conducting shell that surrounds the plasma is accurate to within 5% for aspect ratios greater than 2, poloidal betas less than 50%, and for plasma current channels that exceed one third of the minor toroidal radius. The analytic description for the centre shift of the innermost flux surface that encloses the plasma current (the Shafranov shift) is accurate to within 15% for aspect ratios greater than 2 and poloidal betas below 50%, provided the shift does not exceed one tenth of the minor conducting boundary radius. The Shafranov formulae provide a convenient method for describing the gross equilibrium behaviour of an axisymmetric RFP discharge, as well as an effective tool for designing the poloidal-field systems of RFP experiments.

39821 **Frequency splitting and collisional de-correlation for removing superadiabatic barriers in ECRH experiments.** Rognlien, T.D. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Fusion;* **23**: No. 2, 163-178(Feb 1983).

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A series of test-particle calculations are presented which measure the ECRH velocity diffusion coefficients for two mirror devices - the simple mirror SM-1 and the tandem mirror TMX-U - for monochromatic electron-cyclotron waves. The diffusion coefficients are compared to those from quasi-linear theory. The role of wave-particle resonance overlap and collisional de-correlation for producing stochastic instead of superadiabatic particle motion is investigated. The use of two or more waves with different frequencies is found to increase the number of resonances and thus the chance of resonance overlap; a frequency separation of the axial bounce frequency is optimum for two waves. A spectrum of axial wavenumbers making up a standing wave does not increase the number of resonances and thus does not increase stochasticity. Pitch-angle collisions can also produce significant de-correlation between the wave and particle, owing to the large geometrical enhancement of the gyrophase diffusion in an inhomogeneous magnetic field. Results for fundamental ($\omega$ = $\omega$sub(c)) heating in SM-1 show that using two frequencies instead of one increases heating at

an energy of approx. 10 keV by a factor of about three. Calculations for the tandem mirror TMX-U for an energy of 50 keV show that stochasticity is assured by either resonance overlap or collisional gyrophase diffusion.

39822 **Effect of nuclear elastic scattering on energetic-fusion-product slowing-down.** Choi, C.K.; Hsiao, M.Y. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). *Nuclear Fusion;* **23**: No. 2, 195-200(Feb 1983).

The first Born approximation is used to obtain an analytic expression for the energy loss rate of an energetic charged fusion product, which slows down in dense fusion plasmas, by including the nuclear potential into the stopping power. The analytic expression is used for a comparison with the contributions by Coulomb forces and also with the numerical results obtained from both a Monte-Carlo method and experimental observations. It is found that the difference between the analytic results and the experimental values is not significant while the analytic solution agrees remarkably well with the Monte-Carlo simulations on the ion heating effect.

39823 **Fokker-Planck calculations of hot-electron formation by electron cyclotron resonance heating in the TMX-Upgrade tandem-mirror.** Stallard, B.W.; Matsuda, Y.; Nevins, W.M. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Fusion;* **23**: No. 2, 213-223(Feb 1983).

The paper studies cold plasma trapping and heating of hot electrons in mirror geometry using a time-dependent, bounce-averaged Fokker-Planck code with quasi-linear diffusion due to RF heating at fundamental and second harmonic frequencies. With the restriction ksub(parallel)=0, the code models the beam-controlled heating (spatially restricted electric fields) that will be used to create thermal barriers in the TMX-Upgrade tandem-mirror experiment. By spatially localizing the microwave beams, which are strongly absorbed in a single pass, the mean hot-electron energy may be controlled. Heating is away from the midplane to control anisotropy (Psub(perpendicular)/Psub(parallel)). For a given magnetic field geometry and cold-plasma source temperature Tsub(s), the parameters of the hot electrons scale with the quantity chi is identical to epsilon$^2$/nsub(s)ω, where epsilon is the electric field, nsub(s) is the cold-plasma density, and ω is the frequency.

39824 **Stability of plasma confinement systems with an energetic particle component. Report on the Cornell Workshop, Ithaca, New York, USA, 19-21 May 1982.** Seyler, C.E.; Sudan, R.N. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies; Cornell Univ., Ithaca, NY (USA). School of Electrical Engineering). *Nuclear Fusion;* **23**: No. 2, 247-251(Feb 1983).

This paper reports on the Cornell Workshop, Ithaca, New York, held 19-21 May 1982, on Stability of Plasma Confinement Systems with an Energetic Particle Component.

39825 **Topics in strong Langmuir turbulence.** Nicholson, D.R. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). *Physica Scripta;* **27**: No. 2, 77-82(Feb 1983).

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Progress in two approaches to the study of strong Langmuir turbulence is reported. In two spatial dimensions, numerical solution of the Zakharov equations yields a steady state involving linear growth, linear damping, and a collection of coherent, long-lived entities which might loosely be called solitons. In one spatial dimension, a statistical theory is applied to the cubically nonlinear Schroedinger equation and is solved analytically in a special case.

39826 **Physics of hot plasmas.** ter Haar, D. (Oxford Univ. (UK). Magdalen Coll.). *Physica Scripta;* **T2**: No. 1, 5-9(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

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A survey is given of some recent developments in plasma physics, especially in theoretical plasma physics.

39827 **Waves and instabilities in a magnetized plasma.** Dawson, J.M. (California Univ., Los Angeles (USA). Dept. of Physics). *Physica Scripta;* **T2**: No. 1, 20-28(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

Work on computer simulation of waves and instabilities in magnetized plasmas is reviewed. Included are verification of linear theory. Particular emphasis is given to investigation of nonlinear processes involved in the saturation of instabilities and of wave damping; these include a nonlinear cyclotron resonance and particle trapping in intense waves.

39828 **Topics in strong Langmuir turbulence.** Nicholson, D.R. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). *Physica Scripta;* **T2**: No. 1, 48-53(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

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Progress in two approaches to the study of strong Langmuir turbulence is reported. In two spatial dimensions, numerical solution of the Zakharov equations yields a steady state involving linear growth, linear damping, and a collection of coherent, long-lived entities which might loosely be called solitons. In one spatial dimension, a statistical theory is applied to the cubically nonlinear Schroedinger equation and is solved analytically in a special case.

39829 **Major disruptions, inverse cascades, and the Strauss equations.** Montgomery, D. (College of William and Mary, Williamsburg, VA (USA). Dept. of Physics). *Physica Scripta;* **T2**: No. 1, 83-88(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

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Current-carrying plasmas in a strong d.c. magnetic field are subject to violent disruptions above certain thresholds. At present difficult to verify, explanations are typically sought in terms of "tearing modes". An alternative explanation is in terms of inverse magnetic helicity cascades, generated from a variety of possible sources of small-scale MHD turbulence. Strongly anisotropic MHD plasmas may be described by the Strauss equations. Indications of turbulent inverse cascade behavior for the Strauss equations are sought, in parallel with earlier examples from MHD and fluid mechanics.

39830 **Topics in plasma instabilities: trapped-particle modes and MHD.** Rosenbluth, M.N. (Texas Univ., Austin (USA). Inst. for Fusion Studies). *Physica Scripta;* **T2**: No. 1, 104-109(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

The non-linear theory is now the principal frontier in stability research and has made great advances in the past few years, although it is far from having predictive capability. Of particular interest are Direct Interaction Approximation mode-coupling calculations and introduction of "clump effects" which go a long way toward explaining the broad-frequency spectra which are seen experimentally. Perhaps the biggest question mark as to whether our qualitative understanding is at all correct is the recent stellarator experiments on Wendelstein, which showed that, at least in that geometry, drift waves were closely associated with plasma currents. This is in complete contrast to all the linear theory predictions which have, however, only been made for tokamaks. The most dangerous of these predicted microinstabilities, at least in the collisionless limit, is the trapped-particle mode driven by unfavorable curvature. In this paper the author points out that in some proposed tandem mirror schemes these microinstabilities become very similar in their properties to macroscopic MHD flute modes, thereby providing a link between the two classes of instabilities.

39831 **Nonlinear three-wave system. Strange attractors and asymptotic solutions.** Bussac, M.N. (Ecole Polytechnique, 91 - Palaiseau (France). Centre de Physique Theorique). *Physica Scripta;* T2: No. 1, 110-118(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

An analytical method is developed for the investigation of the nonlinear state resulting from instability saturation by resonant mode-coupling. When parameters are varied, the attractors of motion undergo bifurcations to increasingly complex periodic solutions and the appearance of chaotic solutions. These features are shown to be explainable on the basis of a one dimensional map which is analytically derivable from the original system of differential equations. Moreover, an analytical expression for the solutions is derived in terms of a "random" phase whose evolution is given by the one dimensional map.

39832 **Theory of current drive with lower hybrid waves.** Liu, C.S.; Chan, V.S. (General Atomic Co., San Diego, CA (USA)). *Physica Scripta;* T2: No. 1, 158-160(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

A mechanism is proposed whereby high phase velocity lower hybrid waves can interact with lower parallel velocity electrons through non-linearly excited plasma waves. Significant steady-state current can be sustained by the r.f. after the ohmic field is turned off in a tokamak provided the initial electron distribution has a substantial runaway tail.

39833 **Recent topics in physics of hot plasmas in space environment.** Hasegawa, A. (Bell Labs., Murray Hill, NJ (USA)). *Physica Scripta;* T2: No. 1, 223-227(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

A brief review is presented on the subject of recent interest in physics of hot plasmas in space environment. The subjects chosen here are the double layer, the reconnection of magnetic line of force, and the Jupiter's magnetosphere.

39834 **Review of double layer simulations.** Smith, R.A. (Science Applications, Inc., McLean, VA (USA)). *Physica Scripta;* T2: No. 1, 238-251(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

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A critical review of numerical simulations of plasma double layers is presented. Physical aspects of the double-layer problem are discussed, together with numerical methods appropriate to treat them. Particular emphasis is given to examining boundary conditions and their effect on the physical dynamics. Some physical processes currently thought to be important for double layers are discussed, and the simulation results are described with particular emphasis on their relation to these concepts. The review concludes with an interpretive discussion of the results together with comments on their applicability to laboratory situations and to double layers in space. Some suggestions for future directions in double layer simulations are offered.

39835 **Nonlinear phenomena in laboratory and space plasmas.** Wong, A.Y. (California Univ., Los Angeles (USA). Dept. of Physics). *Physica Scripta;* T2: No. 1, 262-270(1982). (CONF-820618—).

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

Laboratory observations of wave trapping and generation of density cavities verified quantitatively the predictions of the nonlinear Schroedinger equation. Recent observations on the resonant interactions between electromagnetic waves and ionospheric plasmas are interpreted as first tentative evidence for the existence of cavitons in the ionosphere.

## 7002 Fusion Power Plant Technology

*REFER ALSO TO CITATION(S) 39090, 39767*

39836 **(AD-A—122421/1) Stability and symmetry in inertial confinement fusion. Memorandum report.** Emery, M.H.; Bodner, S.E.; Boris, J.P.; Colombant, D.G.; Cooper, A.L. (Naval Research Lab., Washington, DC (USA)). 9 Dec 1982. 18p. (NRL-MR—4947). NTIS, PC A02/MF A01.

The asymmetries of spherical implosions driven by direct laser illuminations are of fundamental concern to the inertial confinement fusion community because they provide severe limitations on high gain pellet designs. Theoretical progress on several fronts has recently been made through numerical simulations in providing a more complete understanding of the physical processes involved in these asymmetries and instabilities. The results also suggest methods of controlling these processes and their implications for laser fusion systems design. Stability and symmetry issues have been investigated. Laser matter coupling and scaling laws relating the asymmetry results to spherical pellet designs have been investigated. Principle results include finding (1) the requirements for thermal smoothing of laser nonuniformities, (2) reduced Rayleigh-Taylor growth rates and saturation via the nonlinear Kelvin-Helmholtz roll-up, (3) that perturbation wavelengths greater than the shell thicknesses are most likely to cause an asymmetric implosion, (4) a new theory based on vortex shedding that explains the reduced linear Rayleigh-Taylor growth rates and (5) a possible wavelength-intensity window for direct illumination where the requirements of pellet velocity, symmetry, and efficiency necessary for high gain can be simultaneously met.

39837 **(CEA-CONF—6269) Laser-matter interaction studies at Centre d'Etudes de Limeil.** Andre, M.; Bernard, A.; Bosca, G. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). May 1982. 11p. (CONF-820528—8). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701654.

From US/Japan seminar on theory and application of multiple ionized plasmas produced by laser and particle beams; Nara, Japan (2 May 1982).

A review is made of the laser-matter interaction and implosion experiments carried out at Centre d'Etudes de Limeil with the two following neodymium glass lasers; the monobeam 50 J - 1ns P102 laser for the interaction with foils and the eight beam 400 J - 0.5ns OCTAL laser for the implosion of glass microballoons.

39838 **(CEA-CONF—6370) Anomalous transport and radiation absorption by ion turbulence in laser-produced plasmas.** Monchicourt, P. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Jun 1982. 13p. (In French, English). (CONF-820618—12). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701655.

From International conference on plasma physics; Goteborg, Sweden (7 Jun 1982).

A theoretical and numerical model simulating the evolution of a laser produced plasma is described. The effects of ion turbulence due to electron heat flux in the conductor region, and electron suprathermal flux, are presented. The ion turbulence leads to transport inhibition and anomalous absorption.

39839 **(CONF-830428—) Fourth US stellarator workshop. Proceedings.** (Oak Ridge National Lab., TN (USA)). Apr 1983. Contract W-7405-ENG-26. 276p. NTIS MF A01. Order Number DE83012810.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

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A title listing of the 14 included papers is given. (MOW)

39840 (CONF-830428—, pp 8-39) **ATF-1 program status.** Lyon, J.F. (Oak Ridge National Lab., TN). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39841 (CONF-830428—, pp 98-120) **Review of helical axis research.** Reiman, A. (Princeton Univ., NJ). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39842 (CONF-830428—, pp 121-154) **Modular heliac stellarator.** Mai, L.P. (Westinghouse, Fusion Engineering, Madison, PA); Gibson, G.; Chu, T.K. Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39843 (CONF-830428—, pp 155-163) **Free boundary finite beta heliac equilibria.** Betancourt, O. (New York Univ., NY). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39844 (CONF-830428—, pp 176-197) **Modular coil design and magnetic surfaces in Heliac.** Shestakov, A.I.; Mirin, A.A.; O'Neill, N.J. (Lawrence Livermore National Lab., CA). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39845 (CONF-830428—, pp 234-238) **Compact stellarators.** Harris, J.H.; Masden, B.F. (Oak Ridge National Lab., TN). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39846 (CONF-830428—, pp 239-266) **Steepest descent moment method for three-dimensional MHD equilibria.** Hirshman, S.P.; Whitson, J.C. (Oak Ridge National Lab., TN). Apr 1983. NTIS MF A01.

From 4. US Stellarator Design Center workshop; Oak Ridge, TN, USA (14 Apr 1983).

39847 (CONF-830589—1) **Design of the Advanced Toroidal Facility (ATF-1).** Johnson, R.L.; Nelson, B.E.; Adams, O.B.; Lyon, J.F.; Jernigan, T.C.; Thompson, P.B. (Oak Ridge Y-12 Plant, TN (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE83012631.

From 10. National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCCHE) annual meeting; Knoxville, TN, USA (25 May 1983).

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The Advanced Toroidal Facility (ATF-1) is a torsatron being designed at ORNL as a replacement for the ISX-B tokamak. The concept for the device includes two continuous helical field coils and a set of twelve toroidal field coils. The vacuum vessel is placed inside the helical field coils and an external toroidal shell support structure is provided to react all coil and vacuum-vessel loads. The present design status for all systems is discussed.

39848 (DOE/DP/40131—1) **Ambipolar potential measurement plans and instrumentation. Final report, 1 October 1980-30 September 1982.** Dahlbacka, G.; Stringfield, R.; Glaros, S.; Buck, V.; Larsen, J.; Burr, L.; Boyle, M.; Lepage, J.; Cirigliano, R. (Physics International Co., San Leandro, CA (USA); ARACOR, Sunnyvale, CA (USA)). Mar 1983. Contract AC08-80DP40131. 82p. NTIS, PC A05/MF A01. Order Number DE83013413.

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A Thomson parabola charged particle spectrometer was built with an energy resolution of 80 keV and an active silicon detector array that is read by a computer-compatible CAMAC. The instrument was checked out at the University of Rochester Omega Laser facility. Experiments to measure the ambipolar potential and the dE/dx thermonuclear target to within 50 keV are now possible. The ion temperature of the burn can be determined to within 10%.

39849 (DOE/ER/52074—T1) **Large-coil-test-facility fault-tree analysis.** (Minority Enterprise Service Associates, Orem, UT (USA)). 31 May 1982. Contract AC01-81ER52074. 168p. NTIS MF A01. Order Number DE83002783.

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An operating-safety study is being conducted for the Large Coil Test Facility (LCTF). The purpose of this study is to provide the facility operators and users with added insight into potential problem areas that could affect the safety of personnel or the availability of equipment. This is a preliminary report, on Phase I of that study. A central feature of the study is the incorporation of engineering judgements (by LCTF personnel) into an outside, overall view of the facility. The LCTF was analyzed in terms of 32 subsystems, each of which are subject to failure from any of 15 generic failure initiators. The study identified approximately 40 primary areas of concern which were subjected to a computer analysis as an aid in understanding the complex subsystem interactions that can occur within the facility. The study did not analyze in detail the internal structure of the subsystems at the individual component level. A companion study using traditional fault tree techniques did analyze approximately 20% of the LCTF at the component level. A comparison between these two analysis techniques is included in Section 7.

39850 (DOE/ER/52076—6) **Blanket design and performance for the LOTUS fusion-fission hybrid test facility.** Abdel-Khalik, S.I.; Haldy, P.A.; Kumar, A. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering; Ecole Polytechnique Federale, Lausanne (Switzerland). Lab. de Genie Atomique). Mar 1983. Contract AT06-82ER52076. 120p. NTIS, PC A06/MF A01. Order Number DE83013493.

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This report summarizes the results of studies performed during 1982 to design an optimized blanket for the initial series of experiments to be conducted in the LOTUS test facility at the Swiss Federal Institute of Technology in Lausanne (EPFL). The experiments are expected to begin in early 1984. An Overview of different hybrid blanket design concepts proposed to date is first given. The technological and economic implications of the different blanket design philosophies are discussed to provide the basis and rationale for the thorium fast-fission blanket design concept selected for the first series of experiments. Detailed description, dimensions, and characteristics of the selected blanket design are given. The neutronic optimization studies on which the design is based are described in detail. Instrumentation and measurement techniques to be used in LOTUS are described elsewhere.

39851 (DOE/ET/51015—T5) **Phaedrus tandem mirror. Status report, Spring 1983.** (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). 1983. Contract AC02-78ET51015. 10p. NTIS, PC A02/MF A01. Order Number DE83013432.

During the spring of 1983, the Phaedrus group undertook a major up to air to improve diagnostic capabilities, modify RF antennas and clean up the inner vacuum surfaces of accumulated getter material. This time was also used to analyze more thoroughly our present data base and correlate it with relevant theoretical predictions. A neutral beam build up code has been developed to model RF central stream trapping and heating, neutral gas charge exchange losses with finite gyroradius effects, and beam aiming sensitivity. MHD stability of the central cell stand alone operation has been explained by a radial ponderomotive force which opposes the centrifugal force due to bad field line curvature. First drafts of research papers on RF trapping, electron cyclotron heating, the stand alone mode, and MHD instability studies were completed. All of these papers require more experiments to tie up loose ends but the loose ends were identified more clearly by this process. The remainder of this report will be organized by experimental area, describing in limited detail the status of current research, recent modifications to diagnostic and machine hardware and immediate future experimental objectives.

**39852 (DOE/ET/52040—T13) Effect of synchrotron radiation on the advanced fueled field-reversed mirror.** Ho, S.K. (Illinois Univ., Urbana (USA). Dept. of Nuclear Engineering). 1980. Contract AC02-76ET52040. 54p. (COO—2218-272). NTIS, PC A04/MF A01. Order Number DE83013014.

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The objective of this study is to investigate the effect of synchrotron radiation on the energy balance or advanced fuels in the field-reversed mirror (FRM) fusion device. The FRM configuration is simulated by the Hill's vortex model. The synchrotron radiant energy loss can be computed by adding the blackbody contribution (0 < omega < omega*) and the transsparent contribution (omega* < omega < infinity), where omega is the radiation frequency and omega* is the cutoff frequency. The cutoff frequency is defined by the frequency at which the plasma's optical depth $\alpha$(omega)L is unity, where $\alpha$ is the absorption coefficient and L is the plasma dimension. The transparent synchrotron radiation at the higher frequencies is not negligible since it is relatively unaffected by proposed reflectors. Wall reflectivity of 0.9 is assumed. The transport equation is traced along a ray across the plasma using the Runge-Kutta techniques. The power loss is obtained by an angular integral of the result with appropriate geometrical factors. Using the FRM reactor design parameter from C. Baker et al. with electron temperature of 70 keV in the Cat-D burn cycle, the cut-off frequency is located at about nine times the cyclotron fundamental frequency. The transparent portion of the synchrotron radiation is about 0.6 of the blackbody counterpart. The net synchrotron radiation power loss is evaluated to be 0.1 MW whereas the fusion power is found to be 2.3 MW, so the synchrotron radiation power loss only accounts for less than 5% of the total fusion power. Similar results are obtained for the D-$He^3$ cycle.

**39853 (EGG-FT—6277) Irradiation and testing of SPAULRAD-S for fusion-magnet applications.** Schmunk, R.E. (Idaho National Engineering Lab., Idaho Falls (USA)). May 1983. Contract AC07-76ID01570. 16p. NTIS, PC A02/MF A01. Order Number DE83013374.

This report describes work on the irradiation and testing of a fusion magnet insulator material, SPAULRAD-S, which is made from S-glass cloth and polyimide. Circular disks 11.1 mm diameter by 0.46 mm thick were irradiated in two facilities, the Advanced Test Reactor (ATR) at the Idaho National Engineering Laboratory and the Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory. Neutron fluences attained in these irradiations were $3.41 \times 10^{25}$ n/m$^2$ (E > 1 MeV) and $3.17 \times 10^{26}$ n/m$^2$ (total) for the ATR and $1.9 \times 10^{21}$ n/m$^2$ (E > 0.1 MeV) and $2.8 \times 10^{21}$ n/m$^2$ (total) for the IPNS. In addition a gamma dose of $3.0 \times 10^8$ Gy was obtained in the ATR irradiation. Temperatures of 325 K and 4.2 K were used for the ATR and IPNS irradiations, respectively. Post-irradiation tests included static compression, compression fatigue, and electrical resistance. No failures were observed in static compression tests when the specimens were loaded to a maximum attainable stress of 2750 MPa. Only one of five specimens from the ATR irradiation group failed in fatigue after cycling to 640 MPa for 277,500 cycles. No failures were observed for the IPNS specimens when cycled to the same maximum stress for 646,640 cycles. No change in electrical resistance was observed for the IPNS irradiation group compared to the control specimens ($6 \times 10^{11}$ Ohms) whereas a decrease by a factor of ten was found for the ATR group. These results are very encouraging for the use of SPAULRAD-S in fusion reactor magnets.

**39854 (ITEF—61(1982)) Optimization of a heavy ion driver for controlled fusion.** Koshkarev, D.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701933.

The charge exchange method of ion accumulation for the purpose of heavy ion fusion is considered. The ion accumulation in the charge exchange method occUrs at the minimum charge (+1), and the acceleration at a sufficiently high ion charge, which leads to reduction of the cost of the whole facility. Total cost of the heavy ion driver is formed of the cost of the linear accelerator and that of the system of storage rings. It is shown that some heavy ion driver parameters for controlled fusion are determined only with account for economic considerations. In particular the substantiation for the choise of the ion charge under acceleration in the charge exchange method requires economic ratios participation.

**39855 (KFKI—1982-69) Magnetic surfaces for a perturbed spheromak plasma.** Ag, A.; Paris, Gy.; Nemeth, G. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1982. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83701660.

7 refs.

The spheromak plasma is considered, in the force-free condition. For different harmonics the differential equation for the field lines is integrated and the magnetic surfaces are discussed. The confinement against the magnetic field perturbations is treated.

**39856 (LA-UR—83-1435) Computational simulations of explosive-driven plasma-quench opening switches.** Greene, A.E.; Oliphant, T.A.; Brownell, J.H.; Nickel, G.H.; Weiss, D.L. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 5p. (CONF-830621—15). NTIS, PC A02/MF A01. Order Number DE83012784.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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High-explosive-driven plasma opening switches have been modeled in one dimension using the Lagrangian MHD code RAVEN. These calculations have been made in both cylindrical and planar geometry. Simple compression can account for observed resistance increases at early times (time-of-flight of the high-explosive detonation products across the plasma conducting channel). Our results suggest that some improvements in switch performance might be achieved through a judicious choice of gases in the plasma channel and by lowering the pressure in the channel.

**39857 (LASL—78-32) Laser Fusion Program at Los Alamos.** (Los Alamos National Lab., NM (USA)). 1978. Contract W-7405-ENG-36. 31p. NTIS, PC A03/MF A01. Order Number DE83013446.

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The Laser Fusion Program at Los Alamos is pursuing the development of high-energy carbon dioxide gas lasers for the demonstration of scientific feasibility of laser fusion in 1984. The short pulse, high-energy carbon dioxide laser is the most advanced laser candidate for a fusion reactor system. It has a demonstrated efficiency of over 2% in a system that delivers over a kilojoule, and because it uses a gaseous laser medium, is capable of being designed to operate at the high repetition rates which will be required. The Helios laser which became operational at Los Alamos in April 1978, will permit extensive experimentation on achieving the very high fuel compressions needed for laser fusion. A vigorous experimental program, coupled with theoretical design and target fabrication efforts, supports our progress toward the breakeven milestone and near-term military application experiments. A broadly based systems group provides guidance on problem areas which need to be addressed for the future.

**39858 (LBL—15857) Shielding considerations for neutral-beam injection systems.** de Seynes, X. (Lawrence Berkeley Lab., CA (USA)). Mar 1983. Contract AC03-76SF00098. 55p. NTIS, PC A04/MF A01. Order Number DE83013294.

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Results of a study on the geometry of an FED-A Neutral Beam Injector beamline duct shield are presented. Also included is a calculation of dose rates, as a function of time, from an activated NBI. The shielding investigations consisted of varying the parameters of the geometry and transporting particles through it using the MCNP Monte-Carlo code. The dose rates were calculated by the ACDOS3 code using realistic MCNP results. A final-to-incident flux ratio of $6.5 \times 10^{-7}$ can be achieved through the use of a 65.5 cm reentry duct. This is for a realistic source and pure water shielding material. The activated NBI produced a dose rate of 15.9 mrem/hr two and a half days after shutdown of the reactor.

**39859 (NIIEFA-P-B—0565) Calculation of the neutral inductance coefficients in a toroidal magnet system with arbitrary shape magnet coils.** Mingalev, B.S. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1982. 52p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83701937.

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The analytical formulae are obtained and tabulated are the coefficients of mutual inductance of two axial-symmetric subsystems in a toroidal magnet system, consisting of piecewise-round, rectangular and D-shape magnet coils. Calculations for the INTOR device toroidal magnet system are performed as an example.

**39860 (NRCN—520) Nuclear fusion programs - present and future.** Greenspan, E. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). Aug 1982. 30p. (In Hebrew). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83701662.

Major nuclear fusion research and development programs in the world are described, with emphasis on magnetic-confinment-based methods. The approach to scientific feasibility demonstration and to the development of commercial fusion reactors is examined. International collaboration in nuclear fusion research and development, as well as promising directions for fusion development, are discussed. Possible involvement of Israel in nuclear fusion research and development is briefly considered.

**39861 (NRL-MR—4896) Experimental methods for studying the Rayleigh-Taylor instability of ablatively accelerated targets.** Grun, J.; Emery, M.H.; Herbst, M.J.; McLean, E.A.; Obenschain, S.P.; Ripin, B.H.; Stamper, J.A.; Whitlock, R.R. (Naval Research Lab., Washington, DC (USA)). 17 Jun 1983. Contract AI08-79DP40092. 32p. NTIS, PC A03/MF A01. Order Number DE83013621.

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We describe new diagnostic methods for the study of hydrodynamic instabilities in ablatively accelerated targets. These methods include face-on x-ray backlighting that does not require a backlighting laser beam (for growth rate measurement), and a tracer dot technique (for tracking ablation plasma flow). The targets in our experiments are periodically perturbed to provide initial conditions for the growth of the Rayleigh-Taylor instability.

**39862 (NRL-MR—5118) Stimulated Brillouin backscatter in long scale length plasmas.** Colombant, D.G.; Manheimer, W.M.; Gardner, J.H. (Naval Research Lab., Washington, DC (USA)). 24 Jun 1983. Contract AI08-79DP40092. 31p. NTIS, PC A03/MF A01. Order Number DE83013817.

Stimulated Brillouin backscatter in long scale length plasmas is calculated using a wave kinetic model. These calculations make use of computer hydrodynamic profiles for these plasmas. Results are presented for the parameters of the joint NRL-LLNL experiments and for reactor size pellets of 5 mm characteristic length. Means of reducing high levels of backscatter for the latter case are investigated.

**39863 (ORNL/TM—8364) Thermal/stress analyses of the EBT-SA split-mirror coil.** Mayhall, J.A.; Byington, G.A.; Forseman, J.W.; Hammonds, C.J.; Haste, G.R.; Johnson, R.L.; Livingston, J.L. (Oak Ridge National Lab., TN (USA)). Jun 1983. Contract W-7405-ENG-26. 64p. NTIS, PC A04/MF A01. Order Number DE83013856.

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A proposal was made in December 1978 to replace some of the standard mirror coils on ELMO Bumpy Torus-Scale (EBT-S) with coils which had the center windings removed, called split-mirror coils. The advantages of such a replacement were: diagnostic measurements could be made in regions in real space and in velocity space which would not otherwise be accessible, and experiments could be carried out in the high magnetic field region. A detailed thermal/stress analysis of the epoxied copper cooling tube was performed, and it was found that with the conditions of case cooling, tensile stresses almost twice ultimate would be induced in the epoxy that bonds the cooling copper tube to the aluminum case. As a result, the epoxy would fail. A new cooling scheme was designed, and temperatures and stresses were calculated. The temperatures and gradients were drastically reduced, and the maximum stress was found to be about one-half the yield stress. It was found (using fracture mechanics analysis) that the new nonepoxied cooling scheme would ensure no failures.

**39864 (RL—82-039) Annual report to the Laser Facility Committee, 1982.** (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). Mar 1982. 328p. NTIS (US Sales Only), PC A15/MF A01. Order Number DE83701663.

The report covers the work done at, or in association with, the Central Laser Facility during the year April 1981 to March 1982 under the headings; glass laser facility development, gas laser development, laser plasma interactions, transport and particle emission studies, ablative acceleration and compression studies, spectroscopy and XUV lasers, and, theory and computation. Publications based on the work of the facility which have either appeared or been accepted for publication during the year are listed.

**39865 (SAND—82-2732C) PBFA II conceptual design.** Johnson, D.L.; Neau, E.L.; Turman, B.N. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 12p. (CONF-830621—20). NTIS, PC A02/MF A01. Order Number DE83013633.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

The PBFA-II accelerator conceptual design is outlined. Initial Marx generator studies indicate a sound design of the energy storage section of the accelerator. Computer modeling of the pulse forming network indicates double-bounce charging can produce the desired machine output at safe field stress levels. The effects of obtainable jitters in the various accelerator components have been studied and appear to have an acceptable degradation on machine output. Research and development is under way on a low jitter, laser triggered switch.

**39866 (SAND—83-0019C) Automated performance history database for the Particle Beam Fusion Accelerator-I.** Boyer, W.B.; Peterson, G.D. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 7p. (CONF-830621—6). NTIS, PC A02/MF A01. Order Number DE83012630.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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The PBFA-I accelerator contains 36 relatively independent parallel modules. Peak signal levels and switch fire times from up to 300 points on the accelerator are recorded as single values by a computer-controlled accelerator Performance Monitoring and Evaluation System (PMES). In addition to being used for post-shot analysis, these data values are stored in a keyed access, relational database. This database contains the historical performance of every monitored pulse power component. Raw timing data is combined with another database containing fixed cable lengths and propagation times to compute module delays and switch turn on times. Interactive software has been written to perform various kinds of data analyses. These include plots of historical performance of each device and statistical analyses of selected sets of data over many shots.

**39867 (SAND—83-0108C) Ultraviolet-laser triggering of a 5-megavolt multistage gas switch.** Adams, R.G.; Moore, W.B.; Woodworth, J.R.; Dillon, M.M.; Morgan, F.; Penn, K.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 12p. (CONF-830621—26). NTIS, PC A02/MF A01. Order Number DE83013641.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

Ultraviolet-laser-triggered switching experiments have successfully controlled the operation of a 5-mv, multistage gas switch. A comparison between KrF and frequency quadrupled Nd:YAG at various laser energies has revealed superior switching performance

using the KrF laser. A new switching diagnostic utilizing optical fibers to view switch fluorescence has yielded detailed information about behavior of individual stages of the multistage gas switch.

39868 **(SAND—83-0270C) E-beam pulsewidth scaling for a large KrF laser.** Ramirez, J.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830621—21). NTIS, PC A02/MF A01. Order Number DE83013632.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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Electron-beam generator engineering trade-offs involved in decreasing the output duration of a large KrF laser by a factor of two so as to double the peak power delivered to an ICF target are discussed.

39869 **(SAND—83-0304C) Electrochemical characterization of liquid resistors.** Whiteley, R.V. Jr.; Wilson, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-830621—5). NTIS, PC A02/MF A01. Order Number DE83012623.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

The chemical reaction products caused by polarization at each electrode were identified. Chronopotentiometry was then used to ascertain the limitations on current density to avoid polarization. Because the polarization effects are cumulative and sufficient time must be allowed for solution re-equilibration, maximum duty cycles were determined for various current densities and $CuSO_4$ concentrations. Accelerated life tests were also performed with actual PBFA-type resistors. The tests showed that the chronopotentiometric experiments produced somewhat conservative guidelines for operating the resistors oriented with the cathode up. It was also shown that, with horizontal or cathode-down operation, a significantly longer current pulse can be endured without leading to resistor failure.

39870 **(SAND—83-0351C) Review of repetitive-pulse-power component technology.** Sarjeant, W.J.; Rohwein, G.J. (Sandia National Labs., Albuquerque, NM (USA); State Univ. of New York, Buffalo (USA)). 1983. Contract AC04-76DP00789. 15p. (CONF-830621—2). NTIS, PC A02/MF A01. Order Number DE83011784.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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The trend in repetitive-pulse-power system design is toward higher energies, larger average power levels, and faster pulse-repetition rates. This trend results in requirements for components with higher reliability, lower losses, and longer life times. Critical components for these pulsed power systems will be reviewed. Emphasis in this paper will be placed on those components and materials requiring significant development efforts. Capacitors for example, are one of the weakest elements in high-power pulsed systems especially when operated at high-repetition frequencies for extended periods of time. Switches are by far the weakest active components in pulse-power systems. Improved insulation in systems and components is essential to increasing energy density and reliability. Results of recent capacitor and switch experiments are discussed. Recent developments in switch and pulse-transformer design are reviewed.

39871 **(SAND—83-0544C) Laser-triggered switch results from a frequency quadrupled Nd:YAG laser.** Hamil, R.A.; Smith, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 12p. (CONF-830621—12). NTIS, PC A02/MF A01. Order Number DE83012871.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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A 3MV modified PBFA trigatron switch has been successfully triggered by the 266 nm UV beam of a Nd:YAG laser in a water-insulated transmission line test facility. Focusing the 2 ns FWHM 25 +- 5 mJ laser pulse into the 65 psig $SF_6$ atmosphere, triggered the switch gap from 69% to 90% of the self-break voltage (V/sub SB/ $\approx$ 2.3 MV). The characteristic linear slope is less than 5 ns per 10% of V/sub SB/ with closure delay times less than those of the 20 ns KrF laser at twice the energy. Two data points deviating from the rest of the set increased the one-sigma jitter from 1.5 ns to 3.9 ns. More LTS data have been collected after the addition of a second trigatron which is also laser triggered. Jitters of 2.3 ns and 1.5 ns were measured for laser energies of 20 mJ or less. The initial implications are that a single 150 mJ Nd:YAG laser can satisfactorily trigger five or more switches to achieve low jitter between the modules of a particle accelerator as well as other large pulsed power devices.

39872 **(SAND—83-1000C) Research design models: a new category.** Burgeson, D.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830593—1). NTIS, PC A02/MF A01. Order Number DE83013466.

From American Engineering Model Society seminar; San Diego, CA, USA (3 May 1983).

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This paper discusses the concept of a research design model and how it differs from an engineering design model. Essentially, the research design model draws on the methods, materials and processes of engineering design models but more emphasis is placed on conceptualization in 3-D. Typically, equipment and processes in research are unique. Often, there are competing concepts from which to decide. The approach which is evolving at Sandia National Laboratories mixes preliminary, engineering and research design on the same model.

39873 **(SAND—83-1007C) Alternative to gas purging in pulse charged repetitive spark gaps.** Buttram, M. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. (CONF-830621—3). NTIS, PC A02/MF A01. Order Number DE83012494.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

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This paper discusses a technique to produce a high-voltage spark gap that recovers in times as short as 1 msec. Historically, high rates of recovery have been achieved by purging spark gaps. The present design bypasses purging to achieve recovery in still gas. On the negative side, these fast-recovering spark gaps have a rather long resistive phase and their shot life may be limited. Working experience is limited to two pulse operations in the self-firing mode. Recovery has been achieved to 700 kV, 35 kA, and 1 kHz. The anomalous recovery seems to be related to the dominance of the formative phase in the gas-breakdown process. The formative phase being relatively insensitive in certain cases to the gas density, breakdown can be made independent of the gap's previous pulses.

39874 **(SAND—83-1016C) Breakdown of water under long term stress.** Buttram, M.; O'Malley, M. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 17p. (CONF-830621—8). NTIS, PC A02/MF A01. Order Number DE83012636.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

If high-dielectric-constant fluids like water could be made to support electric stress for times approaching a millisecond, it should be possible to charge megajoule pulsed-power systems directly from rapidly discharging mechanical devices. The limit on allowable stress times comes from the relatively low resistivity of high-dielectric-constant fluids. Resistivity may be increased by improving the purity of the fluid and by cooling it. This paper reports on the breakdown strength of water purified to its intrinsic resistivity level, then chilled nearly to freezing. Pulses of several hundred microseconds duration were applied to electrode areas of 80, 400, 2000, and 10,000 $cm^2$. Small samples showed a hysteresis effect where the strength of the sample depended strongly on previous pulses. A typical lowering of the dielectric strength with increased area (area effect) was also observed. These data are used to demonstrate the applicability of the statistical model of area effects.

**39875 (UCID—19623) Recovery of uranium-233 from a thorium breeding blanket by pyrochemical techniques.** Coops, M.S.; Knighton, J.B. (Lawrence Livermore National Lab., CA (USA); Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 8 Dec 1982. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01. Order Number DE83012885.

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We have carefully evaluated several processes that might be suitable for uranium recovery from thorium metal, and have chosen two that hold great promise. Both are simple non-aqueous methods that can readily be performed by remote means, and both require only a few simple process steps.

**39876 (UCRL—15341-81-4) Growth of $KH_2PO_4$ crystals at constant temperature and supersaturation. Final report, 20 October 1980-20 October 1981.** Loiacono, G.M.; Zola, J.; Kostecky, G. (Philips Labs., Briarcliff Manor, NY (USA)). Feb 1982. Contract W-7405-ENG-48. 57p. NTIS, PC A04/MF A01. Order Number DE83013792.

A large three-zone cyrstallizer system was constructed and successfully operated for growing $KH_2PO_4$ single crystals. Under conditions of constant crystallization temperature and supersaturation, growth rates exceeding 5 mm per day were demonstrated for $KH_2PO_4$ crystals of 5 x 5 cm cross section. The optical quality of these crystals was equivalent to that of crystals grown at rates presently considered as state-of-the-art (~ 1 mm/day). Sample crystals were supplied for comparison testing. The three-zone system appears to be ideally suitable for growth of large-diameter $KH_2PO_4$ crystals for the Laser Fusion Program.

**39877 (UCRL—88665) Subnanosecond-rise-time, low-impedance pulse generator.** Druce, R.; Vogtlin, G. (Lawrence Livermore National Lab., CA (USA)). 3 Jun 1983. Contract W-7405-ENG-48. 4p. (CONF-830621—24). NTIS, PC A02/MF A01. Order Number DE83013793.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

Portions are illegible in microfiche products.

This paper describes a fast rise, low-impedance pulse generator that has been developed at the Lawrence Livermore National Laboratory. The design specifications of this generator are: 50-kV operating voltage, 1-ohm output impedance, subnanosecond rise time, and a 2 to 10 nanosecond pulse length. High repetition rate is not required. The design chosen is a parallel-plate, folded Blumlein generator. A tack switch is utilized for its simple construction and high performance. The primary diagnostic is a capacitive voltage divider with a B probe used to measure the current waveform.

**39878 (UCRL—89160) Nuclear-data needs for inertial-confinement fusion (ICF).** Haight, R.C.; Motz, H.T. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA)). 9 May 1983. Contract W-7405-ENG-48. 6p. (CONF-830586—1). NTIS, PC A02/MF A01. Order Number DE83012940.

From 13. international data committee meeting; Rio de Janeiro, Brazil (16 May 1983).

Our survey was limited to ICF programs in the United States. It included researchers in laser and heavy ion fusion, target design, target diagnostics, and conceptual reactor design. We asked each of these people to read the current data needs for magnetic fusion energy and to comment on additional data that they require.

**39879 Parameter space for magnetized fuel targets in inertial confinement fusion.** Lindemuth, I.R.; Kirkpatrick, R.C. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* **23**: No. 3, 263-284(Mar 1983).

A simple, zero-dimensional model describing the temporal behaviour of an imploding-shell, magnetized fuel inertial confinement fusion target is formulated. The model includes effects not normally considered in inertial confinement fusion such as magnetic back-pressure on the imploding shell, magnetic reduction of thermal conductivity, magnetic diffusion, and Ohmic heating. The model is simple enough to permit a survey of the parameter space available for magnetized fuel by computing the behaviour of thousands of targets. The survey predicts the existence of a totally new region in parameter space where significant thermonuclear fuel burn-up can occur. The new region is characterized by very low fuel densities, very low implosion velocities, and, most important, driver requirements reduced by several orders of magnitude, suggesting that 'break-even' experiments may be possible with existing inertial confinement fusion drivers. The computed results are in reasonable agreement with more complete two-dimensional magneto-hydrodynamic simulations.

**39880 Radial dependence of decay times of emissions from injected impurities in Alcator A tokamak.** Allen, S.L.; Moos, H.W. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics); Marmar, E.S.; Rice, J.E. (Massachusetts Inst. of Tech., Cambridge (USA). Francis Bitter National Magnet Lab.). *Nuclear Fusion;* **23**: No. 3, 303-309(Mar 1983).

The characteristics of EUV emissions from the ionization states of injected impurities which exist outside the core of the Alcator A plasma ($r/a>=0.5$) are presented. These results are compared with the emissions from the core ionization states to investigate their radial dependence. In deuterium discharges, the ionization states of silicon which exist outside the core (e.g. Si XII) have shorter decay times than those of the core states (e.g. Si XIII), but the scalings of the decay times with plasma current and toroidal field are similar for the two ionization states in the two regions. The difference between the decay times of the ionization states in the two regions increases as the mass of the background ion is increased ($^3$He and $^4$He discharges). The behaviour of other injected impurities (Al, Fe, and Mo) is presented; it is also observed that the decay times of the ionization states of these impurities which exist outside of the plasma core are shorter than the corresponding core states. The difference in the decay times is modelled with a computer code and is found to be qualitatively consistent with a radially constant spreading diffusion coefficient with no (inward) convection.

**39881 Anisotropic pressure equilibrium in a toroidal stellarator.** Hitchon, W.N.G. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering). *Nuclear Fusion;* **23**: No. 3, 383-386(Mar 1983).

Letter-to-the-editor.

Equilibria of a toroidal stellarator plasma with a pressure tensor of the form P-tensor = Psub(perpendicular)I-tensor + (Psub(parallel)-Psub(perpendicular))n-vector n-vector are calculated to high accuracy within the framework of a low-beta expansion previously employed to find scalar-pressure equilibria. Expressions are obtained for various quantities such as the vertical field and the magnetic-axis shift which are important experimentally; when the helical field is allowed to go to zero, results previously derived for tokamaks are obtained in each case.

**39882 Effect of symmetry requirements on the wavelength scaling of directly driven laser fusion implosions.** Max, C.E.; Lindl, J.D.; Mead, W.C. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Nuclear Fusion;* **23**: No. 2, 131-145(Feb 1983).

The creation of a large, hot atmosphere surrounding a laser fusion target can produce symmetrization of incident beam illumination non-uniformities. This paper discusses the effect of laser wavelength on atmosphere formation and it is shown that for short-wavelength lasers there can be a significant penalty in implosion efficiency when the atmosphere is kept large enough to produce adequate symmetrization. Several ways to improve this situation are considered.

39883 **Measurement of the FeXXV dielectronic recombination rate coefficient in the PLT tokamak plasma.** Bely-Dubau, F.; Faucher, P. (Observatoire de Nice, 06 (France)); Bitter, M.; Hill, K.W.; Von Goeler, S.; Sauthoff, N. (Princeton Univ., NJ (USA). Plasma Physics Lab.); Dubau, J. (Observatoire de Paris, Section de Meudon, 92 (France)); Gabriel, A.H. (Science Research Council, Chilton (UK). Space and Astrophysics Div.); Volonte, S. (Mons Univ. (Belgium). Dept. d'Astrophysique). *Physics Letters [Section] A;* 93: No. 4, 189-192(10 Jan 1983).

The FeXXV dielectronic recombination rate coefficient associated with the 1s-2p core excitation has been measured as a function of the electron temperature in the range from 0.9-3 keV from the observations of the satellite lines emitted from the PLT (Princeton large torus) tokamak plasma. These measurements are compared with recent theoretical predictions of Bely-Dubau et al. as well as with the approximation formulae of Burgess and Merts et al., and the results of Jacobs et al. Excellent agreement is obtained with the more recent calculations.

39884 **Efficient and rapid coupling of laser radiation to a gaseous medium through resonance saturation.** Measures, R.M.; Cardinal, P.G.; Wizinowich, P. (Toronto, Univ., Downsview, Ontario, Canada). pp 202-206 of Electro-optics/Laser International '80 UK. Guildford, Surrey, England; IPC Science and Technology Press (1980). (CONF-8003184—).

From Conference on electro-optics/laser international; Brighton, UK (25 Mar 1980).

It has been shown that coupling of laser energy into a gaseous medium can be achieved extremely rapidly and with high efficiency through resonance saturation. Both a detailed computer code and a simple physical model of this interaction have been developed. The LIBORS (laser interaction based on resonance saturation) computer code represents the atom by a 20-level model and takes account of all of the radiative-collisional processes, while the simple physical model provides considerable insight into the relative importance of the various processes. It has also been shown that this new kind of interaction can lead to the formation of plasma channels that should be ideal for transportation of electron or ion beams for future inertial fusion schemes and to plasma heating rates in excess of 10 to the 13th K per sec.

39885 **(CTO—2117) Use of the regularization method for designing the equilibrium system of a tokamak reactor having a specified plasma geometry.** Filatov, O.G. (UKAEA Research Group, Abingdon. Culham Lab.; Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). [nd]. Translation of Preprint No. B-0551, 1981. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83902258.

An analysis is made of the design of the equilibrium system for a tokamak reactor of specified plasma geometry, using the regularization method. The regularization parameter is chosen so as to make the accuracy of the solution comparable with that of the initial data defined by the plasma parameters.

# 99 GENERAL AND MISCELLANEOUS

## 9901 Management

39886 **(DP-MS—83-34) Integrated personnel system.** Wehman, M.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1983. Contract AC09-76SR00001. 21p. NTIS, PC A02/MF A01. Order Number DE83012199.

The development of the integrated personnel system at the Savannah River Plant to handle almost all of the personnel department's needs from the application through retirement or termination is described. A detailed look at the lateral pay increase programs shows how a computerized system is developed. (GHT)

39887 **(GAO/PLRD—82-33) Department of Energy should exercise more oversight of maintenance and repairs of its multiprogram laboratories.** (General Accounting Office, Washington, DC (USA). Procurement, Logistics, and Readiness Div.). 3 Feb 1982. 13p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD.

This is a statement of the evaluation of DOE's oversight of maintenance and repairs at its multiprogram laboratories (Los Alamos, Sandia, Argonne, Lawrence Berkeley). (DLC)

39888 **(HEDL-SA—2824-FP) Management of source surveillance and inspection.** Hinkelman, W.J. (Westinghouse Hanford Co., Richland, WA (USA)). 30 Mar 1983. Contract AC06-76FF02170. 12p. (CONF-830475—3). NTIS, PC A02/MF A01. Order Number DE83012150.

From American Society for Quality Control conference; Richland, WA, USA (17 Apr 1983).

The systems and procedures used for management of source surveillance and inspection of purchased items and services are presented. Criteria for invoking source inspection, qualification of personnel and documentation of inspection plans are given. The methods used for coordination of field operations and the guidance given to personnel performing source surveillance and inspection are summarized.

39889 **Los Alamos National Laboratory.** Hammel, E.F. Jr. *Physics Teacher;* 580-587(Dec 1982).

This article is a review of LASL. It tells of its beginnings, its personnel, education for personnel, philosophy, and research projects it has been involved with and is currently involved with. (SC)

## 9902 Mathematics And Computers

*REFER ALSO TO CITATION(S) 38521, 38540, 39318, 39407, 39474, 39733, 39760*

39890 **(BNL—33087) Large sample study of generalized maximum-likelihood estimators from incomplete data via self-consistency.** Tsai, W.Y.; Crowley, J. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 35p. NTIS, PC A03/MF A01. Order Number DE83013274.

Self-consistent estimators for estimating distribution functions from incomplete data are presented. In many cases, these estimators are also generalized maximum likelihood estimators. In this paper we discuss the theoretical properties of such estimators: existence, uniform consistency, law of the iterated logarithm and weak convergence. Applications to the produce limit estimator for right-censored data and to the estimator proposed by Turnbull (1976) for doubly (right and left) censored data are also given.

39891 **(DOE/ER/02383—T5) Computing Runge-Kutta starters symbolically.** Purtilo, J. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Jan 1983. Contract AC02-76ER02383. 32p. (COO—2383-0092). NTIS, PC A03/MF A01. Order Number DE83013431.

The use of a Runge-Kutta method to start a multistep code in an initial value problem, as first developed by Gear, is reviewed in detail, elaborating on computational details and measuring the problem's complexity. Using this background we describe the use of VAXIMA, a symbol manipulation program, for constructing and solving the necessary Runge-Kutta system. In addition, we consider extensions made to VAXIMA to make more efficient the interaction between numerical and symbolic runtime environments. A six stage starter at fourth order is explicitly derived, and the conditions for a fifth order starter are presented for application as either a true fifth order method or an estimator to the fourth order term.

39892 **(KFKI—1982-71) Error diagnostics and recovery procedure in a dual-processor computer system.** Gossanyi, A.; Parkanyi, T.; Szabo, G.; Vegh, E. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Sep 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83902385.

Portions are illegible in microfiche products.

Reliability is one of the most important problems of industrial process control computers. This report describes the error protection method used in the computerized control system of the 5 MW research reactor of the Central Research Institute for Physics. The computer system consists of two R-10 processors; at a given time only one of them is executing the control of the reactor. The used on-line error diagnostic algorithms and the error recovery procedures are presented in this paper.

39883 **(KMSF-U—1294) VAX Professional Workstation office automation on a shoe-string.** Downward, J.G. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1983. Contract AC08-82DP40152. 11p. (CONF-830577—1). NTIS, PC A02/MF A01. Order Number DE83011798.

From Digital Equipment Computer Users Society (DECUS) symposium; St. Louis, MO, USA (23 May 1983).

Over a number of years, KMS developed a number of quick and dirty productivity tools for our technical staff. The availability of a VAX, an increased number of on-line terminals, increased use of the system by non-programmers, and the installation of a non-DEC word processing system quickly brought out the weaknesses in these tools. What was needed was a user-friendly VAX interface for our professional staff that required minimal understanding of VAX, its utilities, or its use. The VAX Professional Workstation is the outgrowth of an effort to provide this functionality without incurring additional software costs. The VAX Professional Workstation provides a menu-driven user interface to (1) VAX document preparation (editing, filing, spelling, formatting and output to a letter-quality printer), (2) file transfer to the non-DEC word processors, (3) calendar management, (4) reminder messages, (5) phone list management, (6) electronic mail, (7) desk calculator, (8) personal databases and (9) user-tailorable workstations. Because the VAX Professional Workstation was targeted for a wide range of technical skill levels, extensive on-line help is provided, and CAI courses are provided to acquaint users with the basic skills and information needed to function in the VAX environment.

39894 **(LA-UR—83-1362) Multigrid semi-implicit hydrodynamics revisited.** Dendy, J.E. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 22p. (CONF-830581—1). NTIS, PC A02/MF A01. Order Number DE83012675.

From Conference on large scale scientific computation; Madison, WI, USA (16 May 1983).

The multigrid method has for several years been very successful for simple equations like Laplace's equation on a rectangle. For more complicated situations, however, success has been more elusive. Indeeed, there are only a few applications in which the multigrid method is now being successfully used in complicated production codes. The one with which we are most familiar is the application by Alcouffe to TTDAMG. We are more familiar with this second application in which, for a set of test problems, TTDAMG ran seven to twenty times less expensively (on a CRAY-1 computer) than its best competitor. This impressive performance, in a field where a factor of two improvement is considered significant, encourages one to attempt the application of the multigrid method in other complicated situations. The application discussed in this paper was actually attempted several years ago. In that paper the multigrid method was applied to the pressure iteration in three Eulerian and Lagrangian codes. The application to the Eulerian codes, both incompressible and compressible, was successful, but the application to the Lagrangian code was less so. The reason given for this lack of success was that the differencing for the pressure equation in the Lagrangian code, SALE, was bad. In this paper, we examine again the application of multigrad to the pressure equation in SALE with the goal of succeeding this time without cheating.

39895 **(LBL—16149) Uniform data interface.** Bronson, M. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 4p. (CONF-830576—3). NTIS, PC A02/MF A01. Order Number DE83013845.

From Real-time computer applications in nuclear and particle physics conference; Berkeley, CA, USA (16 May 1983).

In a data acquisition/analysis environment, data are available from a variety of sources. By presenting data in a uniform format, available through a simple access interface, a facility can be developed to allow user programs access to these different sources with a minimum of difficulty. This also encourages the development of filter programs that may be joined together to analyze and display the data.

39896 **(ORNL/CSD—119) Sparse orthogonal schemes for structural optimization using the force method.** Heath, M.T.; Plemmons, R.J.; Ward, R.C. (Oak Ridge National Lab., TN (USA)). May 1983. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01. Order Number DE83013739.

Historically there are two principal methods of matrix structural analysis, the displacement (or stiffness) method and the force (or flexibility) method. In recent times the force method has been used relatively little because the displacement method has been deemed easier to implement on digital computers, especially for large sparse systems. The force method has theoretical advantages, however, for multiple redesign problems or nonlinear elastic analysis because it allows the solution of modified problems without restarting the computation from the beginning. In this paper we give an implementation of the force method which is numerically stable and preserves sparsity. Although it is motivated by earlier elimination schemes, in our approach each of the two main phases of the force method is carried out using orthogonal factorization techniques recently developed for linear least squares problems.

39897 **(RFP—3519) Subset selection under random censorship.** Kim, J.S. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Mar 1983. Contract AC04-76DP03533. 20p. (CONF-830496—1). NTIS, PC A02/MF A01. Order Number DE83013683.

From Colorado/Wyoming ASA meeting; Denver, CO, USA (27 Apr 1983).

Suppose we want to model the situation commonly taking place, for example, in industrial life-testing in which two-component series system is understudy. The system functions if and only if both the Type A component and the Type B component are functioning. The distribution or an unknown parameter in the distribution of the Type A component is of interest. Let $X_1$, $X_2$, ..., X/sub n/ be independent and identically distributed random variables denoting lifelengths of n Type A components with a continuous distribution function F, and let $Y_1$, $Y_2$, ..., Y/sub n/ be independent and identically distributed random variables denoting lifelengths of n Type B components also with a continuous distribution function H(.). Failure of the Type B component causes the system failure, thereby making it impossible to observe the failure time of the Type A component. The random variables $Y_1$, $Y_2$, ..., Y/sub n/ are referred to as time-to-censorship or censoring random variables, and the distribution function H(.) as the censoring distribution. We assume that ($X_1$, $Y_1$), ($X_2$, $Y_2$), ..., (X/sub n/, Y/sub n/) is an independent and identically distributed sequence of random pairs defined on a common probability space. Our observations consist of the minima, $Z_1$ - min ($X_1$, $Y_1$), $Z_2$ = min ($X_2$, $Y_2$), ..., Z/sub n/ = min (X/sub n/, Y/sub n/, which are i.i.d. random variables. It is the objective of this paper to formulate a k-sample selection problem under random censorship.

39898 **(SAND—83-0229) Adaptive techniques for time-delay estimation and tracking.** David, R.A.; Stearns, S.D. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 5p. (CONF-830628—5). NTIS, PC A02/MF A01. Order Number DE83011795.

From American control conference; San Francisco, CA, USA (22 Jun 1983).

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This paper discusses the problem of adaptive time-delay estimation in the specific case where the recorded input signals are sinusoids with additive noise. We consider two simple adaptive techniques which do not require transforms and are capable of tracking a nonstationary, time-varying delay. First, a method which makes use of a two-pole, all-pass adaptive filter is introduced. An LMS-type of adaptive algorithm is derived, and the associated error surface is discussed. The performance of this adaptive structure is then compared to that of the adaptive delay element recently introduced by Etter. Simulation results are compared on the basis of delay estimate accuracy, rate of convergence, and the ability to track time-varying phase shifts.

39899 **(SAND—83-8227) NEWPLOT: a general-purpose scientific plotting package.** Goldsmith, J.E.M. (Sandia National Labs., Livermore, CA (USA)). Jun 1983. Contract AC04-76DP00789. 36p. NTIS, PC A03/MF A01. Order Number DE83013268.

This report describes the use of the computer program NEWPLOT to prepare high-quality scientific plots, with a minimum of effort, on a variety of plotting devices. Parameter input to NEWPLOT can be saved as a disk file for subsequent modification and reuse. NEWPLOT acts as a user-friendly front end for accessing many of the plotting routines available with the subroutines in the commercial DISSPLA package from ISSCO.

39900 **(SAND—1304C) Boolean methods of optimization over independence systems.** Hulme, B.L. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 14p. (CONF-830647—1). NTIS, PC A02/MF A01. Order Number DE83013671.

From SIAM conference on the application of discrete mathematics; Cambridge, MA, USA (27 Jun 1983).

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This paper presents both a direct and an iterative method of solving the combinatorial optimization problem associated with any independence system. The methods use Boolean algebraic computations to produce solutions. In addition, the iterative method employs a version of the greedy algorithm both to compute upper bounds on the optimum value and to produce the additional circuits needed at every stage. The methods are extensions of those used to solve a problem of fire protection at nuclear reactor power plants.

39901 **(UCRL—89157) Lecture notes for contact-impact algorithms for large-deformation finite-element analysis.** Hallquist, J.O. (Lawrence Livermore National Lab., CA (USA)). 6 May 1983. Contract W-7405-ENG-48. 36p. (CONF-830582—4). NTIS, PC A02/MF A01. Order Number DE83013039.

From Structural dynamics meeting; Ispra, Italy (16 May 1983).

Finite element codes with contact-impact capability are applicable to a class of structural problems where adjacent components may independently slide, separate, and impact along interfaces. Problems of this sort are common in the defense community for analyzing axisymmetric gun fired projectiles, laydown bombs, and a variety of shape charge designs of either the jet or fragment type. The nuclear industry has interest in analyzing the impact of shipping casks containing radioactive materials, pipe to pipe impact, as well as soil-structure interaction problems. In the development that follows, we consider three-dimensional algorithms. Similar techniques are employed in two dimensions. Several example applications are shown.

39902 **(UCRL—89172) Element choices for explicit and implicit nonlinear finite-element computation. ISPRA courses on structural dynamics - lecture notes.** Goudreau, G.L. (Lawrence Livermore National Lab., CA (USA)). May 1983. Contract W-7405-ENG-48. 30p. (CONF-830582—1). NTIS, PC A03/MF A01. Order Number DE83013041.

From Structural dynamics meeting; Ispra, Italy (16 May 1983).

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The confrontation of the finite element technology with the awesome number crunching required for the nonlinear problem has forced a new assessment. The finite element community discovered that for impact, wave propagation and even slower impulsively driven dynamic problems, the finite difference hydrocodes were much more efficient, albeit requiring contorted mesh topologies to model practical geometries and fifty thousand time steps to follow a quasi-static process or reach static equilibrium. The experience of engineering analysis at the Lawrence Livermore National Laboratory has straddled both worlds, and the intent of this lecture is to review choices in the context of the two and three dimensional implicit and explicit Lagrangian codes developed in our Methods Development Group. The explicit DYNA2D and DYNA3D and implicit NIKE2D and NIKE3D of Hallquist form the focus of this discussion.

39903 **Gaussian-Quadrature formulas for integral $^{00}$O e/ sup -x2/g(x)dx.** Kahaner, D.; Tietjen, G.; Beckman, R. (Los Alamos Scientific Lab., NM). *Journal of Statistical Computation and Simulation;* **15**: 155-160(1982).

Statisticians are frequently faced with evaluating numerically integrals of the form I/sub g/ = integralo/sup infinity/ e/sup -x2/ g(x)dx where g(x) is some function of X. It is obvious that the statisticians in particular need a Guassian quadrature formula over the half infinite range and appropriate for the e/sup (-x2) integrand. The purpose of this paper is to provide such a tool. Tables are included which list the nodes (x/sub i/) and weights (w/sub i/) for an n = 10, 20, 30, 40 point approximation of the form I/sub g/ = integralo/sup infinity/ e/sup (-x2)/g(x)dx ≅ Σ(from i=1 to n) w / sub (i)/g(x/sub i/). (SC)

## 9903 Information Handling

*REFER ALSO TO CITATION(S) 38509*

39904 **(CONF-830484—1) Toward a technical communications career.** Robinson, T.W. Jr. (Oak Ridge National Lab., TN (USA)). 1983. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE83012648.

From 3. annual careers in technical communications seminar; Knoxville, TN, USA (18 Apr 1983).

In a general sense, technical communication can be simply defined as the conveyance of information pertaining to scientific or technological research and development activities from the originator to the intended audience. In an applied sense, the term technical communication is most often defined by the originating organization or individual and may range from the very basic level of distributing copies of research notes on a specific experiment to colleagues to such complex levels as the publication of a resource-authority textbook on a broad technical field of study for international distribution throughout the scientific, business, industrial, and academic communities. Preparation for a career by selecting course work and society membership is described.

39905 **(GRS—50) Information system of the U.S. Nuclear Regulatory Commission.** Farber, G. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Sep 1982. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750675.

On the basis of legal regulations the U.S. NRC maintains a far-reaching information system by means of which their documents are easily made available to the interested public. The essential parts of the information system are - the central Public Document Room in Washington, D.C., - the National Technical Information Center in the Department of Commerce, - the co-operation with the Government Printing Office, - the Nuclear Safety Information Center in the Oak Ridge National Laboratory, and - the National Energy Software Center in the Argonne National Laboratory. Via these facilities the NRC provide all interested institutions with information on the activities in connection with their statutory tasks. Accordingly numerous documents concerning of approval and monitoring of nuclear facilities as well as the use, transport and storage of fissionable material, are granted for perusion.

39906 **(NP—3902113) Services for the analysis and evaluation of information. Final report.** Hall, H.J. (Rutgers--the State Univ., New Brunswick, NJ (USA)). 22 Dec 1982. 122p. Rutgers The State Univ. of New Jersey, Graduate School of Library and Information Studies, 4 Huntington St., New Brunswick, NJ 08903.

Skilled services for the analysis and evaluation of information (IAE) go beyond searching and retrieval to provide information that has been critically evaluated for use. This is a study of what IAE is and does, based on field interviews and extensive seminar discussions with information managers, analysts, and major users. IAE is a form of team research that depends on one-to-one interactions between the information customer, the research user, and an experienced professional analyst. Replies from a questionnaire addressed to customers and analysts in training place first importance on keeping communications open directly between them.

To earn peer acceptance at the highest level, the analyst must have demonstrated sound judgment in addition to the expected skills in information processing. IAE systematically adds to the facts what different people think about the facts, and it encourages the parallel processing of value judgments. This often goes beyond the limitations inherent in sequential-flow systems that only take commands: such passive systems tend to measure output in terms of quantity, cost, and speed, assuming that a value-judgment must be logical to be valid, and suppressing personal opinion except insofar as it can be reduced to data. In contrast to these conventional axioms, IAE is constantly probing for bias as to facts or procedures, to discover what is wrong now with whatever was the best answer before. Recommendations for a flexible information policy note the need for a type of recoverable feedback exchange, more like human analysis, with internal warning loops for nondata inputs to help process the processing of information. Case histories and conclusions for success in IAE are summarized in parallel statements of what is required, and associated hazards to avoid.

# CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

## A


**Acorn Structures, Inc., Concord, MA (USA)**
DOE/SERI Solar-Passive-Hybrid Manufactured-Buildings Program. Final report, 8:38803 (R;US)

**Aerojet Energy Conversion Co., Sacramento, CA (USA)**
Combustion-enhancement and pollutant-control research with acoustically induced mixing. Final report, 8:38418 (R;US)

**Aerospace Corp., El Segundo, CA (USA)**
Potential role of the distilling industry in supplying ethanol fuel, 8:39078 (R;US)

**AiResearch Mfg. Co., Torrance, CA (USA)**
High-temperature burner-duct-recuperator (HTBDR) program. Annual report, October 1981-September 1982, 8:39056 (R;US)
High-temperature ceramic-heat-exchanger development. Final report, 8:39282 (R;US)

**Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering**
Variational calculation of electron elastic scattering by atomic helium. Master's thesis, 8:39505 (R;US)

**Air Pollution Technology, Inc., San Diego, CA (USA)**
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The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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| AC02-78ER10004 | Illinois Univ., Urbana (USA). Office of Energy Research | |
| | 8:39080 | DOE/ER/10004—5 |

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| AC02-78ER14953 | Illinois Inst. of Tech., Chicago (USA). Dept. of Chemistry | |
| | 8:39158 | DOE/ER/14953—T2 |
| | 8:39159 | DOE/ER/14953—T3 |
| AC02-78ET29011 | Rensselaer Polytechnic Inst., Troy, NY (USA) | |
| | 8:38888 | DOE/ET/29011—T1 |
| AC02-78ET51013 | Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center | |
| | 8:39778 | DOE/ET/51013—83 |
| AC02-78ET51015 | Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering | |
| | 8:39851 | DOE/ET/51015—T5 |
| AC02-79ET10815 | Tennessee Univ., Knoxville (USA) | |
| | 8:39013 | DOE/ET/10815—91 |
| AC02-80ER10613 | Columbia Univ., New York (USA) | |
| | 8:39775 | DOE/ER/10613—1 |
| AC02-80ER10689 | Purdue Univ., West Lafayette, IN | |
| | 8:39182 | Journal of the American Chemical Society 105 NO. 4. 736-742 (23 Feb 1983). |
| AC02-80ER10699 | State Univ. of New York, Stony Brook (USA) | |
| | 8:39288 | DOE/ER/10699—T2 |
| | 8:39304 | DOE/ER/10699—T1 |
| AC02-80ER10715 | Purdue Research Foundation, Lafayette, IN (USA) | |
| | 8:39394 | DOE/ER/10715—3 |
| AC02-80EV10374 | New York Univ., NY (USA). Medical Center | |
| | 8:39358 | DOE/EV/10374—3 |
| AC02-80EV10403 | Illinois Univ., Urbana (USA). Inst. for Environmental Studies | |
| | 8:39343 | DOE/EV/10403—12 |
| AC02-81ER10881 | Temple Univ., Philadelphia, PA | |
| | 8:38690 | Journal of Physical Chemistry 87 NO. 1. 1-4 (6 Jan 1983). |
| AC02-81ER10968 | Colorado State Univ., Fort Collins (USA). Dept. of Chemistry | |
| | 8:39191 | DOE/ER/10968—T1 |
| AC02-81ER40033 | Rockefeller Univ., New York (USA) | |
| | 8:39301 | DOE/ER/40033—38 |
| AC02-82CE30746 | EIC Labs., Inc., Newton, MA | |
| | 8:38793 | CONF-820940—(Nov 1982). |
| AC02-82CE30753 | Tufts Univ., Medford, MA | |
| | 8:39033 | CONF-820940—(Nov 1982). |
| AC03-76SF00012 | California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences | |
| | 8:39399 | DOE/SF/00012—T17 |
| | 8:39400 | DOE/SF/00012—T18 |
| AC03-76SF00098 | Lawrence Berkeley Lab., CA (USA) | |
| | 8:38476 | LBL—15937 |
| | California Univ., Berkeley (USA) | |
| | 8:38559 | LBL—14842-Vol.1 |
| | 8:38560 | LBL—14842-Vol.2 |
| | 8:38817 | LBL—14896 |
| | Lawrence Berkeley Lab., CA (USA) | |
| | 8:38977 | LBL—15517 |
| | 8:39045 | LBL—8688-Rev.3 |
| | 8:39046 | LBL—9416 |
| | 8:39047 | LBL—14838-Rev. |
| | 8:39048 | LBL—15972 |
| | 8:39105 | LBL—16089 |
| | 8:39173 | Journal of Physical Chemistry 87 NO. 1. 26-27 (6 Jan 1983). |
| | 8:39180 | Journal of the American Chemical Society 105 NO. 4. 690-695 (23 Feb 1983). |
| | 8:39183 | Journal of the American Chemical Society 105 NO. 4. 822-827 (23 Feb 1983). |
| | 8:39185 | Journal of the American Chemical Society 105 NO. 2. 216-220 (26 Jan 1983). |
| | 8:39189 | Journal of Physical Chemistry 87 NO. 1. 21-22 (6 Jan 1983). |
| | 8:39236 | LBL—16127 |
| | 8:39302 | LBL—14773 |

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| | 8:39307 | LBL—14459 |
| | 8:39317 | BL-PUB—3033 |
| | 8:39545 | LBL—15510 |
| | **California Univ., Berkeley (USA)** | |
| | 8:39693 | LBL—16136 |
| | **Lawrence Berkeley Lab., CA (USA)** | |
| | 8:39858 | LBL—15857 |
| | 8:39895 | LBL—16149 |
| AC03-76SF00515 | **Stanford Linear Accelerator Center, CA (USA)** | |
| | 8:38811 | SLAC-PUB—3023 |
| | 8:39291 | SLAC-PUB—3072 |
| | 8:39292 | SLAC-PUB—3078 |
| | 8:39293 | SLAC-PUB—3085 |
| | 8:39294 | CAPE—2831(26 Jun 1983). |
| | 8:39298 | CAPE—2828([nd]). |
| | 8:39299 | CAPE—2830([nd]). |
| | **Stanford Univ., CA (USA)** | |
| | 8:39547 | SLAC—PUB-3118 |
| | **Stanford Linear Accelerator Center, CA (USA)** | |
| | 8:39742 | SLAC-PUB—3075 |
| AC03-76SF00700 | **MCC Associates, Silver Spring, MD (USA)** | |
| | 8:38772 | CONF-820940— |
| AC03-77CS34510 | | |
| | 8:38808 | |
| AC03-78CS52184 | **Aerospace Corp., El Segundo, CA (USA)** | |
| | 8:39078 | SAN—2184-T1 |
| AC03-78ET13333 | **Teledyne CAE, Toledo, OH (USA)** | |
| | 8:38876 | DOE/ET/13333—T2 |
| AC03-78ET20110 | **Pennsylvania Univ., Philadelphia (USA). Dept. of Mechanical Engineering and Applied Mechanics** | |
| | 8:38807 | SAN—20110-9 |
| AC03-78ET20460 | **Mobil Tyco Solar Energy Corp., Waltham, MA (USA)** | |
| | 8:38623 | DOE/ET/20460—3 |
| AC03-78SF01424 | **Conoco, Inc., Casper, WY (USA)** | |
| | 8:38446 | DOE/SF/01424—48 |
| AC03-80CS30228 | **New Mexico State Univ., Las Cruces** | |
| | 8:38774 | CONF-820940—(Nov 1982). |
| | **New Mexico State Univ., Las Cruces (USA). Dept. of Mechanical Engineering** | |
| | 8:38802 | DOE/CS/30228—T1 |
| AC03-80SF10816 | **Univ. of Arizona, Tucson** | |
| | 8:38797 | CONF-820940—(Nov 1982). |
| AC03-80SF11509 | **EarthTech Research Corp., Baltimore, MD** | |
| | 8:39034 | CONF-820940—(Nov 1982). |
| AC03-82ER51031 | **JAYCOR, San Diego, CA (USA)** | |
| | 8:39776 | DOE/ER/51031—T1 |
| AC04-76DP00053 | **Monsanto Research Corp., Miamisburg, OH (USA). Mound** | |
| | 8:39308 | MLM—3065(OP) |
| | **Monsanto Research Corp., Dayton, OH (USA)** | |
| | 8:39346 | MLM—3071-(OP) |
| | **Monsanto Research Corp., Miamisburg, OH (USA). Mound** | |
| | 8:39519 | MLM—3070 |
| AC04-76DP00613 | **Bendix Corp., Kansas City, MO (USA)** | |
| | 8:39123 | BDX—613-2949 |
| AC04-76DP00656 | **General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.** | |
| | 8:39526 | GEPP-TIS—532a |
| AC04-76DP00789 | **Sandia National Labs., Albuquerque, NM (USA)** | |
| | 8:38361 | SAND—82-2363 |
| | 8:38462 | SAND—83-0630 |
| | 8:38464 | SAND—83-1078 |
| | **GA Technologies, Inc., San Diego, CA (USA)** | |
| | 8:38507 | GA-A—17121 |
| | **Sandia National Labs., Albuquerque, NM (USA)** | |
| | 8:38512 | SAND—82-1913C |
| | 8:38513 | SAND—82-1928C |
| | 8:38514 | SAND—82-1947C |
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| | 8:38519 | SAND—83-0196C |
| | 8:38520 | SAND—83-0898C |
| | 8:38551 | SAND—83-0247C |
| | 8:38552 | SAND—83-0516 |
| | 8:38658 | SAND—83-1210C |
| | **Sandia National Labs., Livermore, CA (USA)** | |
| | 8:38765 | SAND—83-8021 |
| | **McDonnell Douglas Astronautics Co.-West, Huntington Beach, CA (USA)** | |
| | 8:38766 | SAND—83-8216 |
| | **Sandia National Labs., Livermore, CA (USA)** | |
| | 8:38767 | SAND—83-8217 |
| | **Sandia Labs., Livermore, CA (USA)** | |
| | 8:38768 | SAND—83-8224 |
| | **Sandia National Labs., Albuquerque, NM (USA)** | |
| | 8:38819 | SAND—83-0238 |
| | 8:38866 | SAND—82-2504C |
| | **Stoller (S.M.) Corp., Boulder, CO (USA)** | |
| | 8:38897 | ALO—1020 |
| | **Energy, Inc., Kent, WA (USA)** | |
| | 8:38944 | ALO—1018 |
| | **Sandia National Labs., Albuquerque, NM (USA)** | |
| | 8:38956 | NUREG/CR—2607 |
| | 8:38960 | NUREG/CR—3163 |
| | 8:39016 | SAND—83-0219C |
| | 8:39109 | SAND—83-1218C |
| | 8:39122 | SAND—83-1260C |
| | 8:39139 | SAND—83-1194C |
| | 8:39140 | SAND—83-1279C |
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| | 8:39269 | SAND—82-2186 |
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| | 8:39333 | SAND—83-1147C |
| | 8:39335 | SAND—83-1176C |
| | 8:39338 | SAND—82-2193 |
| | 8:39459 | SAND—81-1970 |
| | **North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy** | |
| | 8:39732 | SAND—83-0139C |
| | **Sandia National Labs., Albuquerque, NM (USA)** | |
| | 8:39736 | SAND—83-0407C |
| | 8:39816 | SAND—83-1341C |
| | 8:39865 | SAND—82-2732C |
| | 8:39866 | SAND—83-0019C |
| | 8:39867 | SAND—83-0108C |
| | 8:39868 | SAND—83-0270C |
| | 8:39869 | SAND—83-0304C |
| | 8:39870 | SAND—83-0351C |
| | 8:39871 | SAND—83-0544C |
| | 8:39872 | SAND—83-1000C |
| | 8:39873 | SAND—83-1007C |
| | 8:39874 | SAND—83-1016C |
| | 8:39898 | SAND—83-0229 |
| | **Sandia National Labs., Livermore, CA (USA)** | |
| | 8:39899 | SAND—83-8227 |
| | **Sandia National Labs., Albuquerque, NM (USA)** | |
| | 8:39900 | SAND—1304C |
| AC04-76DP03533 | **Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant** | |
| | 8:38556 | RFP-Trans—405(Jun 1983). |
| | 8:39107 | RFP—3455 |
| | 8:39108 | RFP—03388 |

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| | 8:39178 | RFP-ABST—06(Jun 1983). |
| | 8:39897 | RFP—3519 |
| **AC04-76EV01013** | **Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM** | |
| | 8:38433 | Environmental Science and Technology 17 NO. 2. 67-71 (Feb 1983). |
| | 8:39355 | |
| | 8:39356 | |
| **AC04-78AL10752** | **New Mexico Health and Environment Dept., Santa Fe (USA). Environmental Improvement Div.** | |
| | 8:38565 | DOE/AL/10752—23 |
| **AC04-79AL10563** | **Terra Tek, Inc., Salt Lake City, UT (USA)** | |
| | 8:38849 | DOE/AL/10563—T17 |
| **AC05-76ET53036** | **Texas Univ., Austin (USA). Inst. for Fusion Studies** | |
| | 8:39780 | DOE/ET/53036—39 |
| **AC05-76OR00033** | **Oak Ridge Associated Universities, Inc., TN (USA)** | |
| | 8:39344 | DOE/NBB—0036 |
| **AC05-76OR01156** | **NLO, Inc., Cincinnati, OH (USA)** | |
| | 8:39238 | NLCO—1181 |
| **AC06-76FF02170** | **Hanford Engineering Development Lab., Richland, WA (USA)** | |
| | 8:38508 | HEDL-SA—2794-FP |
| | 8:38918 | HEDL-SA—2638 |
| | 8:38940 | HEDL-SA—2805-FP |
| | 8:38941 | HEDL-SA—2826-FP |
| | 8:38942 | HEDL-SA—2885-FP |
| | 8:39090 | HEDL-SA—2687-A |
| | 8:39148 | HEDL-SA—2871-FP |
| | 8:39268 | HEDL-SA—2796-FP |
| | **Westinghouse Hanford Co., Richland, WA (USA)** | |
| | 8:39888 | HEDL-SA—2824-FP |
| **AC06-76RL01830** | | |
| | 8:38386 | Archives of Environmental Contamination and Toxicology 11 553-560 (1982). |
| | **Pacific Northwest Lab., Richland, WA (USA)** | |
| | 8:38510 | PNL-SA—10553 |
| | 8:38511 | PNL-SA—11135 |
| | 8:38526 | DOE/EP—0088 |
| | 8:38537 | NUREG/CR—3087 |
| | **Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation** | |
| | 8:38538 | ONWI—462 |
| | 8:38539 | ONWI—464 |
| | **INTERA Environmental Consultants, Inc., Houston, TX (USA)** | |
| | 8:38540 | ONWI—473 |
| | **Pacific Northwest Lab., Richland, WA (USA)** | |
| | 8:38545 | PNL—4744 |
| | 8:38546 | PNL-SA—10694 |
| | 8:38547 | PNL-SA—10712 |
| | 8:38548 | PNL-SA—11332 |
| | **Organization for Economic Co-Operation and Development, 75 - Paris (France)** | |
| | 8:38549 | PNL-SA—11379 |
| | **Pacific Northwest Lab., Richland, WA (USA)** | |
| | 8:38562 | PNL-SA—10973 |
| | 8:38569 | PNL—4688 |
| | 8:38590 | American Chemical Society, Division of Petroleum Chemistry, Preprints 28 NO. 3. 667-674 (M |
| | 8:38599 | PNL-SA—10604 |
| | 8:38720 | PNL-SA—11368 |
| | 8:38764 | PNL—4745 |
| | 8:38855 | PNL—4429 |
| | **Johns Hopkins Univ., Baltimore, MD (USA)** | |
| | 8:38862 | PNL—4231 |
| | **Pacific Northwest Lab., Richland, WA (USA)** | |
| | 8:38863 | PNL-SA—10994 |

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| | 8:38864 | PNL-SA—10999 |
| | 8:38865 | PNL-SA—11172 |
| | 8:38902 | PNL—4685 |
| | 8:38926 | NUREG/CR—3194 |
| | 8:38962 | PNL-SA—11075 |
| | 8:38963 | PNL-SA—11277 |
| | 8:38973 | PNL—4743 |
| | 8:38989 | PNL—4239-Ed.2 |
| | 8:39060 | PNL—4529 |
| | 8:39121 | PNL-SA—11393 |
| | **Battelle Pacific Northwest Labs., Richland, WA (USA)** | |
| | 8:39345 | EPRI-EA—1498-Vol.3 |
| | **Pacific Northwest Lab., Richland, WA (USA)** | |
| | 8:39367 | PNL-SA—11423 |
| | 8:39396 | PNL-SA—11303 |
| | 8:39435 | PNL—4560 |
| | 8:39446 | PNL-SA—11346 |
| | 8:39451 | PNL-SA—11155 |
| | **RE/SPEC, Inc., Rapid City, SD (USA)** | |
| | 8:39471 | ONWI—190(3) |
| | 8:39472 | ONWI—237 |
| | 8:39473 | ONWI—250 |
| | **INTERA Environmental Consultants, Inc., Houston, TX (USA)** | |
| | 8:39474 | ONWI—430 |
| **AC06-77RL01030** | **Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations** | |
| | 8:38550 | RHO-RE-ST—1-P |
| | 8:38563 | RHO-LD—155-P |
| | 8:39458 | RHO-BW-SA—289-P |
| | 8:39475 | RHO-BW-SA—262P |
| | 8:39476 | RHO-BW-SA—286P |
| **AC06-80ER10738** | **Bend Research, Inc., OR (USA)** | |
| | 8:38489 | DOE/ER/10738—1 |
| **AC06-81ER40048** | **Washington Univ., Seattle (USA). Dept. of Physics** | |
| | 8:39509 | DOE/ER/40048—53-L3 |
| | **Washington Univ., Seattle (USA). Nuclear Physics Lab.** | |
| | 8:39684 | DOE/ER/40048—54-L3 |
| | 8:39685 | DOE/ER/40048—55-L3 |
| **AC07-76ID01570** | **EG and G Idaho, Inc., Idaho Falls (USA)** | |
| | 8:38528 | DOE/LLW—3 |
| | 8:38529 | DOE/LLW—18T-Rev.1 |
| | **Battelle Columbus Labs., OH (USA)** | |
| | 8:38535 | EGG—2263 |
| | **EG and G Idaho, Inc., Idaho Falls (USA)** | |
| | 8:38627 | EGG-ELS—6177 |
| | 8:38901 | NUREG/CR—2770 |
| | 8:38933 | EGG-M—04583 |
| | 8:38934 | EGG-M—27882 |
| | 8:38938 | EGG-M—30382 |
| | 8:38939 | EGG-REP—6273 |
| | 8:38945 | EGG-M—02183 |
| | 8:38946 | EGG-M—03783 |
| | 8:38947 | EGG-M—04483 |
| | 8:38948 | EGG-M—06983 |
| | 8:39231 | EGG-M—19782 |
| | 8:39372 | EGG-TF—6236 |
| | **Idaho National Engineering Lab., Idaho Falls (USA)** | |
| | 8:39853 | EGG-FT—6277 |
| **AC07-79ID12079** | **Utah Univ., Salt Lake City (USA). Earth Science Lab.** | |
| | 8:38814 | DOE/ID/12079—88 |
| **AC08-78ET27059** | **Radian Corp., Austin, TX (USA)** | |
| | 8:38851 | DOE/ET/27059—1 |
| **AC08-80DP40131** | **Physics International Co., San Leandro, CA (USA)** | |
| | 8:39848 | DOE/DP/40131—1 |
| **AC08-82DP40152** | **KMS Fusion, Inc., Ann Arbor, MI (USA)** | |
| | 8:39893 | KMSF-U—1294 |
| **AC08-83NV10282** | **EG and G, Inc., Goleta, CA (USA)** | |
| | 8:39218 | S—233-TP |
| | **EG and G, Inc., Las Vegas, NV (USA)** | |
| | 8:39316 | EGG—10282-1018 |

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|---|---|---|
| AC09-76SR00001 | Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. | |
| | 8:38501 | DP—1647 |
| | 8:38502 | DP—1657 |
| | 8:38531 | DP-MS—82-104 |
| | 8:38532 | DP-MS—83-17 |
| | 8:38533 | DP-MS—83-30 |
| | 8:38534 | DP-MS—83-55 |
| | 8:38576 | DPST—82-128-4 |
| | Oak Ridge National Lab., TN (USA) | |
| | 8:38905 | DPST—83-248 |
| | Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant | |
| | 8:38917 | DPSPU—82-30-15 |
| | 8:39224 | Inorganic Chemistry 22 NO. 3. 503-506 (2 Feb 1983). |
| | Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. | |
| | 8:39305 | DP—1654 |
| | 8:39359 | DP—1646 |
| | 8:39360 | DP—1651 |
| | 8:39698 | DP-MS—83-10 |
| | 8:39886 | DP-MS—83-34 |
| AC09-76SR00819 | | |
| | 8:39390 | Ecology 63 NO. 4. 905-911 (Aug 1982). |
| AC11-76PN00014 | Bettis Atomic Power Lab., West Mifflin, PA (USA) | |
| | 8:38916 | WAPD-TM—1342 |
| | 8:39362 | WAPD—336 |
| AC19-79BC10059 | Bartlesville Energy Technology Center, OK | |
| | 8:38459 | Energy Progress 3 NO. 1. 44-49 (Mar 1983). |
| AC21-77ET10415 | Minnick (L. John), Plymouth Meeting, PA (USA) | |
| | 8:39058 | FE—2549-T2 |
| AC21-78ET11031 | General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept. | |
| | 8:38407 | FE—3242-5 |
| AC21-80ET15492 | Air Pollution Technology, Inc., San Diego, CA (USA) | |
| | 8:38376 | DOE/ET/15492—T40 |
| AC21-80MC14061 | Exxon Research and Engineering Co., Linden, NJ (USA) | |
| | 8:38343 | DOE/MC/14061—1-Rev.1 |
| AC21-80MC14705 | Institute of Gas Technology, Chicago, IL (USA) | |
| | 8:38344 | DOE/MC/14705—T5 |
| AC21-81MC16477 | Georgia Inst. of Tech., Atlanta (USA). School of Mechanical Engineering | |
| | 8:38345 | DOE/MC/16477—1421 |
| AC21-81MC16551 | New Mexico State Univ., Las Cruces (USA). Dept. of Chemical Engineering | |
| | 8:38444 | DOE/MC/16551—6 |
| AC21-82MC19077 | Pacific Northwest Lab., Richland, WA (USA) | |
| | 8:39019 | DOE/MC/19077—T1 |
| | Battelle Pacific Northwest Labs., Richland, WA (USA) | |
| | 8:39020 | DOE/MC/19077—T2 |
| AC21-82MC19301 | Institute of Gas Technology, Chicago, IL (USA) | |
| | 8:38346 | DOE/MC/19301—2 |
| AC22-77ET10679 | Engineering Societies Commission on Energy, Inc., Washington, DC (USA) | |
| | 8:38415 | DOE/ET/10679—T17 |
| AC22-78ET13377 | Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group | |
| | 8:38359 | FE—3048-1 |
| AC22-79ET14700 | Utah Univ., Salt Lake City (USA). Dept. of Mining and Fuels Engineering | |
| | 8:38340 | DOE/ET/14700—14 |
| AC22-79ET14880 | Delaware Univ., Newark (USA). Dept. of Chemical Engineering | |
| | 8:38341 | DOE/ET/14880—T3 |
| AC22-80PC30021 | Air Products and Chemicals, Inc., Allentown, PA (USA) | |
| | 8:38584 | DOE/PC/30021—T12 |
| AC22-80PC30022 | Mobil Research and Development Corp., Paulsboro, NJ (USA) | |
| | 8:38585 | DOE/PC/30022—5 |
| AC22-80PC30075 | Massachusetts Inst. of Tech., Cambridge (USA) | |
| | 8:38347 | DOE/PC/30075—13 |
| AC22-80PC30139 | OTISCA Industries Ltd., Syracuse, NY (USA) | |
| | 8:38405 | DOE/PC/30139—T3 |
| AC22-81PC40265 | Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. | |
| | 8:38417 | DOE/PC/40265—7 |
| AC22-81PC40270 | Aerojet Energy Conversion Co., Sacramento, CA (USA) | |
| | 8:38418 | DOE/PC/40270—4 |
| AC22-81PC40272 | Solar Turbines, Inc., San Diego, CA (USA) | |
| | 8:39280 | DOE/PC/40272—T3 |
| AC22-81PC40784 | Pennsylvania State Univ., University Park (USA). Coal Research Section | |
| | 8:38348 | DOE/PC/40784—FR-1 |
| | Gulf Research and Development Co., Pittsburgh, PA (USA) | |
| | 8:38349 | DOE/PC/40784—FR-2 |
| AC22-81PC40787 | Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering | |
| | 8:38351 | DOE/PC/40787—8 |
| AC22-81PC41761 | Virginia Commonwealth Univ., Richmond (USA). Dept. of Chemistry | |
| | 8:38353 | DOE/PC/41761—T2 |
| AC22-81PC42692 | Cincinnati Univ., OH (USA). Kettering Lab. | |
| | 8:38430 | DOE/PC/42692—T2 |
| AC22-82PC50046 | Pittsburg and Midway Coal Mining Co., Denver, CO (USA) | |
| | 8:38354 | DOE/PC/50046—1 |
| AC22-82PC50261 | Energy and Environmental Engineering, Inc., Cambridge, MA (USA) | |
| | 8:38421 | DOE/PC/50261—T2 |
| AI01-76ET20319 | Science Applications, Inc., Albuquerque, NM (USA). Alternate Energy Systems Div. | |
| | 8:38857 | DOE/ARS—7315-20741/83/1 |
| AI01-76ET20356 | Jet Propulsion Lab., Pasadena, CA (USA) | |
| | 8:38624 | DOE/JPL—1012-86 |
| AI01-77CS51040 | Ford Motor Co., Dearborn, MI (USA). Research Staff | |
| | 8:39072 | DOE/NASA/0008—79/6 |
| AI01-78ET11417 | Arnold Engineering Development Center, Arnold Air Force Station, TN (USA) | |
| | 8:39014 | DOE/ET/11417—18 |
| AI01-80ET17088 | Engelhard Corp., Edison, NJ (USA). Engelhard Industries Div. | |
| | 8:39021 | DOE/NASA/0241—6 |
| | 8:39022 | |
| AI05-82OR21005 | National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center | |
| | 8:39074 | DOE/NASA/1005—1 |
| AI08-78ET44802 | Geological Survey, Reston, VA (USA) | |
| | 8:38554 | USGS-OFR—83-141 |
| | 8:39468 | USGS-OFR—83-321 |
| AI08-79DP40092 | Naval Research Lab., Washington, DC (USA) | |
| | 8:39861 | NRL-MR—4896 |
| | 8:39862 | NRL-MR—5118 |
| AI19-81BC10525 | Naval Research Lab., Washington, DC (USA). Chemistry Div. | |
| | 8:38475 | DOE/BC/10525—4 |
| AS05-77ER05399 | Louisiana State Univ., Baton Rouge | |
| | 8:39167 | SERI/CP—233/1723(1982). |
| AS05-78ER05940 | Maryland Univ., College Park (USA). Dept. of Physics and Astronomy | |
| | 8:39283 | DOE/ER/05940—001 |

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| AS05-79ER05035 | Rice Univ., Houston, TX (USA). Dept. of Chemistry | |
| | 8:39508 | DOE/ER/06035—5 |
| AS05-79EV05784 | Florida State Univ., Tallahassee, FL | |
| | 8:39174 | Journal of Physical Chemistry 87 NO. 1. 30-40 (6 Jan 1983). |
| AS05-81ER10815 | Univ. of North Carolina, Chapel Hill | |
| | 8:39213 | Journal of Physical Chemistry 87 NO. 1. 23-25 (6 Jan 1983). |
| AS05-81ER10936 | Kentucky Univ., Lexington (USA). Research Foundation | |
| | 8:39126 | DOE/ER/10936—2 |
| AS19-80BC10331 | New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center | |
| | 8:38443 | DOE/BC/10331—9 |
| AT03-79ER10340 | University of Southern California, Los Angeles (USA) | |
| | 8:38338 | DOE/ER/10340—T1 |
| AT03-81ER10924 | Stanford Univ., CA | |
| | 8:39449 | Plant Physiology 70 NO. 2. 370-375 (Aug 1982). |
| AT06-76EV70003 | Montana State Univ., Bozeman (USA). Dept. of Animal and Range Sciences | |
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| AT06-82ER52076 | Washington Univ., Seattle (USA). Dept. of Nuclear Engineering | |
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| | Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering | |
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| FC01-83FE60181 | North Dakota Univ., Grand Forks (USA). Energy Research Center | |
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| | North Dakota Univ., Grand Forks (USA). Dept. of Mechanical Engineering | |
| | 8:38416 | DOE/FE/60181—16 |
| FC02-80CS30334 | Peckham and Wright Architects, Inc., Columbia, MO | |
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| FC02-80CS30343 | North Design A/E/P, Madison, WI | |
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| FC02-80CS30350 | Rensselaer Polytechnic Inst., Troy, NY | |
| | 8:38800 | CONF-820940—(Nov 1982). |
| FC02-80CS30353 | John Weidt Assocites, Inc., Chaska, MN | |
| | 8:38777 | CONF-820940—(Nov 1982). |
| FC02-80CS30363 | Acorn Structures, Inc., Concord, MA | |
| | 8:38785 | CONF-820940—(Nov 1982). |
| | Acorn Structures, Inc., Concord, MA (USA) | |
| | 8:38803 | DOE/CS/30363—T1 |
| FC03-79SF10761 | CLD Group, Inc., Ventura, CA (USA) | |
| | 8:38447 | DOE/SF/10761—3 |
| FC03-80SF11504 | Energy Materials Research Co., Berkeley, CA | |
| | 8:38791 | CONF-820940—(Nov 1982). |
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| FC07-79RA23215 | Turlock Irrigation District, CA (USA) | |
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| FC07-81ID12170 | AiResearch Mfg. Co., Torrance, CA (USA) | |
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| FG02-80CS84003 | Princeton Univ., NJ | |
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| FG03-76ER10058 | California Inst. of Tech., Pasadena | |
| | 8:39350 | Atmospheric Environment 17 NO. 3. 501-522 (1983). |
| FG03-81ER10891 | California Univ., Riverside (USA). Dept. of Plant Pathology | |
| | 8:39393 | CONF-8104206—Absts. |
| FG05-80ET53088 | Texas Univ., Austin (USA). Inst. for Fusion Studies | |
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| FG05-82ER75039 | Kentucky Univ., Lexington (USA). Dept. of Mechanical Engineering | |
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| FG07-81ID12305 | USDOE Idaho Operations Office, Idaho Falls | |
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| | 8:38595 | DOE/ID/12337—T1 |
| FG07-81ID12339 | Georgia Inst. of Tech., Atlanta (USA). Engineering Experiment Station | |
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| FG22-80PC30228 | Virginia Commonwealth Univ., Richmond (USA). Dept. of Chemistry | |
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| | 8:38587 | DOE/PC/30228—T9 |
| FG22-81PC40786 | Brown Univ., Providence, RI (USA). Div. of Engineering | |
| | 8:38350 | DOE/PC/40786—5 |
| FG22-81PC40789 | Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering | |
| | 8:38365 | DOE/PC/40789—T6 |
| FG22-81PC40793 | Western Kentucky Univ., Bowling Green (USA). Ogden Coll. of Science, Technology and Health | |
| | 8:38366 | DOE/PC/40793—T7 |
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| FG22-81PC40807 | Southern Illinois Univ., Carbondale (USA). Coll. of Engineering and Technology | |
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| FG22-82PC50266 | Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Mechanical Engineering | |
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| FG22-82PC50790 | Utah Univ., Salt Lake City (USA). Biomaterials Profiling Center | |
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| FG22-82PC50807 | Duke Univ., Durham, NC (USA). Dept. of Chemistry | |
| | 8:38369 | DOE/PC/50807—T2 |
| FG22-82PC50811 | Rice Univ., Houston, TX (USA). Dept. of Chemical Engineering | |
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| FG22-82PC51260 | Rhode Island Univ., Narragansett (USA). Graduate School of Oceanography | |
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| NAS-7-100-956046 | Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering | |
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| W-31-109-ENG-38 | Argonne National Lab., IL (USA) | |
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| | Los Alamos National Lab., NM (USA) | |
| | 8:39697 | CONF-830214—3 |
| W-7405-ENG-26 | Oak Ridge National Lab., TN (USA) | |
| | 8:38336 | ORNL—5955 |
| | 8:38374 | Environmental Pollution, Series B: Chemical and Physical 4 NO. 3. 219-229 (Nov 1982). |
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| | Oak Ridge Gaseous Diffusion Plant, TN (USA) | |
| | 8:38491 | K/CSD/INF—83/3 |
| | 8:38492 | K-Trans—235(28 Mar 1981). |
| | 8:38493 | K-Trans—247(28 Mar 1981). |
| | 8:38494 | K-Trans—234(18 Dec 1980). |
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| | Oak Ridge National Lab., TN (USA) | |
| | 8:38503 | ORNL/TM—8731 |
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| | Oak Ridge Gaseous Diffusion Plant, TN (USA) | |
| | 8:38572 | K/OA—5261 |
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| | Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice | |
| | 8:38588 | ORNL/MIT—362 |
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| | 8:38593 | CONF-830567—1 |
| | 8:38606 | Water Resources Research 18 NO. 4. 705-712 (Aug 1982). |
| | 8:38871 | CONF-830583—2 |
| | 8:38914 | ORNL—5960 |
| | 8:38932 | NUREG/CR—0200-Vols.1-2-3 |
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| | Tennessee Univ., Knoxville (USA). Dept. of Electrical Engineering | |
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| | 8:39116 | 6. 123-129 (1971). |
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| | Oak Ridge National Lab., TN (USA) | |
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| | Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland) | |
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| | Tennessee Univ., Knoxville (USA) | |
| | 8:39507 | CONF-830301—17 |
| | Oak Ridge National Lab., TN (USA) | |
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| | Bristol Univ. (UK). H.H. Wills Physics Lab. | |
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| | 8:38499 | LA-UR—83-1515 |
| | Japan Atomic Energy Research Inst., Tokai, Ibaraki. Fuel Reprocessing Lab. | |
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| | Los Alamos National Lab., NM (USA) | |
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| CONF-8206185- | (16. international symposium on remote sensing of environment, Buenos Aires, Brazil, 2-9 Jun 1982) | | | |
| 1 | *See* N-8314575 | | | 8:38383 |
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| 36 | *See* DESY-82-077 | DE83750673 | MN -34D | 8:39548 |
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| 51 | *See* LBL-14459 | DE83013510 | MN -34 | 8:39307 |
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| 24 | *See* HEDL-SA-2687-A | DE83012717 | MN -20c | 8:39090 |
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| 31 | *See* BNL-32245 | DE83003951 | MN -28 | 8:39232 |
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| CONF-821217- | (ASHRAE/DOE conference on thermal performance of building envelopes, Las Vegas, NV, USA, 5-9 Dec 1982) | | | |
| 6 | *See* LBL-9416 | DE83013445 | MN -95d | 8:39046 |
| CONF-821239- | (International conference on underwater operations and techniques, Paris, France, 6-8 Dec 1982) | | | |
| | Editions Technip, 27, rue Ginoux, 75 Paris, France | | | 8:39281 |
| CONF-830108- | (6. ASME energy sources technology conference and exhibition, Houston, TX, USA, 30 Jan-3 Feb 1983) | | | |
| 6 | *See* PNL-SA-10604 | DE83013744 | MN -61a | 8:38399 |

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|---|---|---|---|---|
| CONF-830114- | (Energy from biomass and wastes symposium, Lake Buena Vista, FL, USA, 24-28 Jan 1983) | | | |
| 7 | Inst. of Gas Tech., Chicago, IL 60616 | | MN -61a | 8:38615 |
| 8 | Inst. of Gas Tech., Chicago, IL 60616 | | MN -61a | 8:38616 |
| CONF-830138- | (Symposium on nuclear physics, Oaxtepec, Mexico, 4-7 Jan 1983) | | | |
| 3 | *See* BNL-32996 | DE83013066 | MN -34C | 8:39690 |
| CONF-830143- | (Workshop on bosons in nuclei, Philadelphia, PA, USA, 28-29 Jan 1983) | | | |
| 1 | *See* LA-UR-83-1310 | DE83012683 | MN -34D | 8:39721 |
| CONF-830144- | (National Association of Corrosion Engineers meeting, San Francisco, CA, USA, 17-20 Jan 1983) | | | |
| 1 | *See* BNL-33081 | DE83013690 | MN -66d | 8:38845 |
| CONF-830205- | (Waste management conference, Tucson, AZ, USA, 27 Feb-3 Mar 1983) | | | |
| 31 | *See* DP-MS-82-104 | DE83013679 | MN -70B | 8:38531 |
| CONF-830210- | (5. topical conference on radio frequency plasma heating, Madison, WI, USA, 21-23 Feb 1983) | | | |
| 19 | *See* PPPL-2012 | DE83013720 | STD -20f | 8:39815 |
| CONF-830214- | (Workshop on future directions in transplutonium element research, Washington, DC, USA, 28 Feb-2 Mar 1983) | | | |
| 3 | NTIS, PC A04/MF A01; 1 | DE83010724 | MN -34C | 8:39697 |
| CONF-830225- | (Nuclear fuel cycle information workshop, Oak Ridge, TN, USA, 15-17 Feb 1983) | | | |
| 4 | NTIS, PC A05/MF A01; 1 | DE83009791 | MN -83 | 8:39234 |
| CONF-830231- | (Europhysics study conference on electroweak effects at high energies, Erice, Italy, 1-10 Feb 1983) | | | |
| 1 | *See* SLAC-PUB-3118 | DE83012376 | MN -34D | 8:39547 |
| CONF-830301- | (ASME-JSME thermal engineering joint conference, Honolulu, HI, USA, 20-24 Mar 1983) | | | |
| 17 | NTIS, PC A02/MF A01; 1 | DE83009782 | MN -34A | 8:39507 |
| CONF-830303- | (185. American Chemical Society national meeting, Seattle, WA, USA, 20-25 Mar 1983) | | | |
| | Treasurer, 321 Browning Bldg., Univ. of Utah, Salt Lake City, UT 84112 | | | 8:38452 |
| | Am. Chem. Soc., Div. Pet. Chem., Prepr., 28: No. 3, 667-674(Mar 1983) | | | 8:38590 |
| | Am. Chem. Soc., Div. Pet. Chem., Prepr., 28: No. 3, 545-550(Mar 1983) | | | 8:39179 |
| CONF-830311- | (Particle accelerator conference, Santa Fe, NM, USA, 21-23 Mar 1983) | | | |
| 169 | *See* SLAC-PUB-3085 | DE83013107 | MN -28 | 8:39293 |
| 170 | *See* SLAC-PUB-3078 | DE83013106 | MN -28 | 8:39292 |
| 171 | *See* SLAC-PUB-3075 | DE83013108 | MN -28 | 8:39742 |
| 172 | *See* SLAC-PUB-3072 | DE83013126 | MN -28 | 8:39291 |
| CONF-830338- | (APCA specialty meeting on measurement and monitering of non-criteria toxic contaminants, Chicago, IL, USA, 22-24 Mar 1983) | | | |
| 4 | NTIS, PC A02/MF A01; 1 | DE83009788 | MN -41 | 8:39341 |
| CONF-830339- | (Theoretical symposium on intense medium energy sources of strangeness, Santa Cruz, CA, USA, 19-21 Mar 1983) | | | |
| 2 | *See* FERMILAB-CONF-83/35-Thy | DE83013846 | MN -34C | 8:39550 |
| CONF-830358- | (Spring meeting of the Central States Section of the Combustion Institute, Lexington, KY, USA, 21-22 Mar 1983) | | | |
| 1 | *See* CSS/CI-83-23 | | MN -92b | 8:39226 |
| 3 | *See* CSS/CI-83-21 | | MN -96 | 8:39070 |
| 10 | *See* CSS/CI-83-09 | | MN -90i | 8:38413 |
| 11 | *See* CSS/CI-83-22 | | MN -96 | 8:39077 |
| 12 | *See* CSS/CI-83-13 | | MN -90e | 8:38414 |
| 13 | *See* CSS/CI-83-07 | | MN -90c | 8:38337 |
| 14 | *See* CSS/CI-83-04 | DE83012285 | MN -90i | 8:38411 |
| 15 | *See* CSS/CI-83-17 | DE83902033 | MN -61a | 8:38601 |
| 16 | *See* CSS/CI-83-20 | | MN -38 | 8:39279 |
| 17 | *See* CSS/CI-83-19 | | MN -93 | 8:39069 |
| 18 | *See* CSS/CI-83-08 | | MN -90e | 8:38412 |
| 19 | *See* CSS/CI-83-05 | DE83902099 | MN -11 | 8:39342 |
| 20 | Massachusetts Inst. of Tech., Cambridge, MA 02139 | | MN -90b | 8:38410 |
| 21 | *See* CSS/CI-83-16 | | MN -61a | 8:38600 |
| 22 | Northwestern Univ., Department of Chemical Engineering, Evanston, IL 60201 | | MN -96 | 8:39076 |
| CONF-830359- | (14. lunar and planetary science conference, Houston, TX, USA, 1 Mar 1983) | | | |
| 1 | *See* LA-UR-83-1384 | DE83012672 | MN -34C | 8:39672 |
| CONF-830361- | (Cellular automata workshop, Los Alamos, NM, USA, 3-7 Mar 1983) | | | |
| 1 | *See* LA-UR-83-1308 | DE83012703 | MN -48 | 8:39395 |
| CONF-830362- | (IAEA consultants' meeting on the uranium 235 fast-neutron fission cross section, Smolenice, Czechoslovakia, 28-29 Mar 1983) | | | |
| 1 | *See* BNL-NCS-33026 | DE83013116 | MN -34C | 8:39695 |
| CONF-830364- | (American Chemical Society symposium on geochemistry and chemistry of oil shale, Seattle, WA, USA, 25-29 Mar 1983) | | | |
| 1 | *See* LBL-15937 | DE83012956 | MN -4 | 8:38476 |

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|---|---|---|---|---|
| CONF-830365- | (Seminar on energy efficiency and conservation, Lome, Togo, Africa, 30 Mar-8 Apr 1983) | | | |
| 1 | *See* LBL-15972 | DE83012910 | MN -95d | 8:39048 |
| CONF-830366- | (1. national conference on PV applications, photovoltaics for research to reality, Cambridge, MA, USA, 24-26 Mar 1983) | | | |
| 1 | *See* PNL-SA-11368 | DE83013479 | MN -63 | 8:38720 |
| CONF-830369- | (3. metallic magnetism conference, Grenoble, France, 25-26 Mar 1983) | | | |
| 1 | NTIS, PC A03/MF A01; 1 | DE83012577 | MN -34A | 8:39735 |
| CONF-830370- | (Beta-alumnina for sodium-sulfur batteries meeting, Oak Ridge, TN, USA, 8-10 Mar 1983) | | | |
| Summ. | *See* DOE/ER-0168 | DE83013616 | MN -94cb | 8:38976 |
| CONF-830420- | (Society of Photo-Optical Instrumentation Engineers conference, Arlington, VA, USA, 4-8 Apr 1983) | | | |
| 3 | *See* SERI/TP-211-1931 | DE83011959 | STD -63 | 8:38685 |
| CONF-830423- | (5. symposium on safeguards and nuclear material management, Versailles, France, 19-21 Apr 1983) | | | |
| 11 | *See* BNL-NUREG-33064 | DE83013689 | MN -15 | 8:38570 |
| CONF-830428- | (4. US Stellarator Design Center workshop, Oak Ridge, TN, USA, 14-15 Apr 1983) | | | |
| | NTIS MF A01; 2 | DE83012810 | MN -20 | 8:39839 |
| CONF-830432- | (Wind/solar energy conference, Kansas City, MO, USA, 25-26 Apr 1983) | | | |
| 4 | *See* SERI/TP-211-1960 | DE83011956 | STD -60 | 8:38769 |
| CONF-830439- | (3. multi-phase flow and heat transfer symposium, Miami, FL, USA, 18-20 Apr 1983) | | | |
| 7 | *See* EGG-M-02183 | DE83013667 | MN -78 | 8:38945 |
| 8 | *See* EGG-M-03783 | DE83013666 | MN -78 | 8:38946 |
| 9 | *See* EGG-M-04483 | DE83013665 | MN -78 | 8:38947 |
| CONF-830440- | (UCLA symposia on molecular and cellular biology, Keystone, CO, USA, 10-15 Apr 1983) | | | |
| 4 | *See* DOE/EV/03490-2284 | DE83013219 | MN -48 | 8:39418 |
| CONF-830442- | (CSNI specialist meeting on interaction of fire and explosion with ventilation systems in nuclear facilities, Los Alamos, NM, USA, 26-28 Apr 1983) | | | |
| 2 | *See* UCRL-88588 | DE83013038 | MN -41 | 8:39228 |
| CONF-830451- | (American Ceramic Society annual meeting, Chicago, IL, USA, 25-28 Apr 1983) | | | |
| 13 | *See* HEDL-SA-2794-FP | DE83012825 | MN -85 | 8:38508 |
| 16 | *See* DP-MS-83-17 | DE83013680 | MN -70 | 8:38532 |
| CONF-830466- | (DOE workshop on copper alloys, Washington, DC, USA, 14-15 Apr 1983) | | | |
| 5-Rev.1 | *See* UCRL-89034-Rev.1 | DE83013312 | MN -38 | 8:39110 |
| CONF-830474- | (Critical and strategic materials laboratory study group meeting, Idaho Falls, ID, USA, 12-13 Apr 1983) | | | |
| | NTIS, PC A09/MF A01; 1 | DE83013855 | STD -25 | 8:39079 |
| CONF-830475- | (American Society for Quality Control conference, Richland, WA, USA, 17-19 Apr 1983) | | | |
| 1 | *See* HEDL-SA-2638 | DE83012822 | MN -38 | 8:38918 |
| 3 | *See* HEDL-SA-2824-FP | DE83012150 | MN -13 | 8:39888 |
| 4 | *See* HEDL-SA-2871-FP | DE83012156 | MN -4 | 8:39148 |
| CONF-830481- | (RMCOEH occupational and environmental health conference, Park City, UT, USA, 5-8 Apr 1983) | | | |
| 1 | *See* PNL-SA-11155 | DE83011830 | MN -41 | 8:39451 |
| CONF-830484- | (3. annual careers in technical communications seminar, Knoxville, TN, USA, 18 Apr 1983) | | | |
| 1 | NTIS, PC A02/MF A01 | DE83012648 | MN -13 | 8:39904 |
| CONF-830485- | (64. annual American Welding Society meeting, Philadelphia, PA, USA, 24-29 Apr 1983) | | | |
| 2 | *See* EGG-M-19782 | DE83013537 | MN -38 | 8:39231 |
| CONF-830486- | (Electro '83 electronic show and convention, New York, NY, USA, 19-21 Apr 1983) | | | |
| 1 | *See* LBL-15517 | DE83012877 | MN -94c | 8:38977 |
| CONF-830487- | (Western regional energy conference, Richland, WA, USA, 17 Apr 1983) | | | |
| 1 | *See* HEDL-SA-2885-FP | DE83012826 | MN -79a | 8:38942 |
| CONF-830489- | (45. annual meeting of the American Power Conference, Houston, TX, USA, 18-20 Apr 1983) | | | |
| 1 | *See* EGG-M-06983 | DE83013673 | MN -78 | 8:38948 |
| CONF-830490- | (2. international colloquium on endocytobiology, Tubingen, F.R. Germany, 10-17 Apr 1983) | | | |
| 1 | *See* BNL-33155 | DE83013624 | MN -11 | 8:39406 |
| CONF-830491- | (PCI/MOTORCON 83 coference, Orlando, FL, USA, 19-21 Apr 1983) | | | |
| 1 | *See* EGG-M-30382 | DE83013664 | MN -80 | 8:38938 |
| CONF-830496- | (Colorado/Wyoming ASA meeting, Denver, CO, USA, 27 Apr 1983) | | | |
| 1 | *See* RFP-3519 | DE83013683 | MN -32 | 8:39897 |
| CONF-830508- | (163. Electrochemical Society meeting, San Francisco, CA, USA, 8-13 May 1983) | | | |
| 21 | *See* SAND-83-1314C | DE83013265 | MN -4 | 8:39192 |
| CONF-830518- | (29. international symposium of the Instrument Society of America, Albuquerque, NM, USA, 2-6 May 1983) | | | |
| 10 | *See* EGG-M-04583 | DE83013518 | MN -80 | 8:38933 |
| 11 | *See* EGG-M-27882 | DE83013519 | MN -80 | 8:38934 |

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| CONF-830523- | (International conference on radioactive waste management, Seattle, WA, USA, 16-20 May 1983) | | | |
| 11 | NTIS, PC A02/MF A01 | DE83012639 | MN -70 | 8:38524 |
| 13 | *See* PNL-SA-11379 | DE83013257 | MN -70B | 8:38549 |
| 14 | *See* PNL-SA-10694 | DE83013260 | MN -70 | 8:38546 |
| 17 | *See* PNL-SA-10712 | DE83013368 | MN -70 | 8:38547 |
| CONF-830528- | (7. international symposium on packaging and transportation of radioactive materials, New Orleans, LA, USA, 15-20 May 1983) | | | |
| 24 | *See* PNL-SA-11135 | DE83013250 | MN -71 | 8:38511 |
| 26 | *See* SAND-83-0898C | DE83013271 | MN -71 | 8:38520 |
| 28 | *See* SAND-82-1994C | DE83013471 | MN -71 | 8:39242 |
| 29 | *See* SAND-82-1997C | DE83013684 | MN -71 | 8:38518 |
| 30 | *See* GA-A-17121 | DE83013682 | MN -71 | 8:38507 |
| 31 | *See* SAND-82-1913C | DE83013272 | MN -71 | 8:38512 |
| 32 | *See* K/CSD/INF-82/20 | DE83013253 | MN -71 | 8:38509 |
| 33 | *See* SAND-82-1995C | DE83013669 | MN -71 | 8:38516 |
| 34 | *See* SAND-83-0196C | DE83013670 | MN -71 | 8:38519 |
| 35 | *See* SAND-83-1993C | DE83013264 | MN -71 | 8:39248 |
| 36 | *See* SAND-82-1992C | DE83013631 | MN -71 | 8:38515 |
| 37 | *See* SAND-82-1928C | DE83013766 | MN -71 | 8:38513 |
| 38 | *See* SAND-82-1947C | DE83013773 | MN -71 | 8:38514 |
| 39 | *See* SAND-82-1996C | DE83013767 | MN -71 | 8:38517 |
| 40 | *See* SAND-82-1991C | DE83013630 | MN -71 | 8:39241 |
| CONF-830551- | (5. SERI photovoltaic advanced research and development annual review meeting, Denver, CO, USA, 19-21 May 1983) | | | |
| 1 | *See* SAND-83-1210C | DE83012495 | MN -63 | 8:38658 |
| CONF-830553- | (Health Physics Society Chapter meeting, Richland, WA, USA, 1 May 1983) | | | |
| 1 | *See* PNL-SA-11277 | DE83012796 | MN -41 | 8:38963 |
| CONF-830555- | (23. Minefield conference, White Oak, MD, USA, 24-26 May 1983) | | | |
| 1 | *See* SAND-83-1176C | DE83012322 | MN -13 | 8:39335 |
| CONF-830556- | (International workshop on the principles of environmental mutagenesis, carcinogenesis, and teratogenesis, Shanghai, China, 25 May-1 Jun 1983) | | | |
| 5 | NTIS, PC A03/MF A01 | DE83012656 | MN -48 | 8:39416 |
| CONF-830557- | (ORNL workshop on calibration of actinide lung counters, Oak Ridge, TN, USA, 10-13 May 1983) | | | |
| 2 | *See* MLM-3065(OP) | DE83011792 | MN -37 | 8:39308 |
| 3 | NTIS, PC A02/MF A01 | DE83012599 | MN -41 | 8:39409 |
| 4 | *See* Y/DW-435 | DE83011855 | MN -37 | 8:39309 |
| CONF-830561- | (3. national symposium on aquifer restoration and ground water monitoring, Columbus, OH, USA, 25-27 May 1983) | | | |
| 1 | *See* PNL-SA-10973 | DE83013248 | MN -51 | 8:38562 |
| 2 | *See* UCRL-89368 | DE83013861 | MN -11 | 8:39467 |
| CONF-830565- | (Advances in scintillator counting conference, Banff, Alberta, Canada, 15-18 May 1983) | | | |
| 2 | *See* LA-UR-83-1548 | DE83012774 | MN -37 | 8:39306 |
| 3 | *See* S-233-TP | DE83012400 | MN -4 | 8:39218 |
| 4 | NTIS, PC A02/MF A01 | DE83012654 | MN -4 | 8:39147 |
| CONF-830566- | (ENERGY '83 symposium, San Francisco, CA, USA, 16-18 May 1983) | | | |
| 1 | NTIS, PC A02/MF A01 | DE83012591 | MN -13 | 8:38984 |
| CONF-830567- | (5. symposium on biotechnology for fuels and chemicals, Gatlinburg, TN, USA, 10-13 May 1983) | | | |
| 1 | NTIS, PC A02/MF A01 | DE83012597 | MN -4 | 8:38593 |
| CONF-830568- | (International technical appliance conference, West Lafayette, IN, USA, 17-18 May 1983) | | | |
| 2 | NTIS, PC A02/MF A01; 1 | DE83012568 | MN -95d | 8:39036 |
| CONF-830570- | (6. international conference on ion beam analysis, Temple, AZ, USA, 22-27 May 1983) | | | |
| 1 | *See* LA-UR-83-1515 | DE83012777 | MN -4 | 8:38499 |
| 2 | *See* SAND-83-1218C | DE83012870 | MN -25 | 8:39109 |
| 3 | *See* SAND-83-0139C | DE83013307 | MN -34 | 8:39732 |
| 4 | *See* SAND-83-1194C | DE83013309 | MN -34 | 8:39139 |
| 5 | *See* UCRL-89256 | DE83013045 | MN -25 | 8:39155 |
| CONF-830572- | (Symposium on genetic consequences of nucleotide pool imbalance, Research Triangle Park, NC, USA, 9-11 May 1983) | | | |
| 1 | *See* PNL-SA-11303 | DE83012605 | MN -48 | 8:39396 |
| CONF-830573- | (2. international conference on radiation effects in insulators, Albuquerque, NM, USA, 30 May-3 Jun 1983) | | | |
| 1 | *See* PNL-SA-11393 | DE83013261 | MN -25 | 8:39121 |
| CONF-830574- | (International thermal spray conference, Essen, F.R. Germany, 2-4 May 1983) | | | |
| 1 | *See* HEDL-SA-2796-FP | DE83012154 | MN -25 | 8:39268 |
| CONF-830575- | (Spring meeting of the Japan Society of Corrosion Engineers, Tokyo, Japan, 18-20 May 1983) | | | |
| 1 | *See* BNL-33025 | DE83013115 | MN -4 | 8:39082 |
| CONF-830576- | (Real-time computer applications in nuclear and particle physics conference, Berkeley, CA, USA, 16-20 May 1983) | | | |
| 1 | NTIS, PC A02/MF A01 | DE83012584 | MN -28 | 8:39287 |
| 3 | *See* LBL-16149 | DE83013845 | MN -32 | 8:39895 |

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|---|---|---|---|---|
| CONF-830577- | (Digital Equipment Computer Users Society (DECUS) symposium, St. Louis, MO, USA, 23-27 May 1983) | | | |
| 1 | *See* KMSF-U-1294 | DE83011798 | MN -32 | 8:39893 |
| CONF-830578- | (IEA workshop on electrolytic hydrogen production, Ispra, Italy, 30 May-1 Jun 1983) | | | |
| 2 | *See* BNL-39235 | DE83012223 | MN -94c | 8:38578 |
| 3 | *See* BNL-32964 | DE83013278 | MN -90a | 8:38577 |
| CONF-830579- | (5. annual DARPA/AFOSR symposium, Eastsound, WA, USA, 16-18 May 1983) | | | |
| 1 | *See* UCRL-89270 | DE83013047 | MN -11 | 8:39466 |
| CONF-830581- | (Conference on large scale scientific computation, Madison, WI, USA, 16-19 May 1983) | | | |
| 1 | *See* LA-UR-83-1362 | DE83012675 | MN -32 | 8:39894 |
| CONF-830582- | (Structural dynamics meeting, Ispra, Italy, 16-20 May 1983) | | | |
| 1 | *See* UCRL-89172 | DE83013041 | MN -32 | 8:39902 |
| 2 | *See* UCRL-89156 | DE83013042 | MN -32 | 8:39528 |
| 3 | *See* UCRL-89182 | DE83013037 | MN -38 | 8:39761 |
| 4 | *See* UCRL-89157 | DE83013039 | MN -32 | 8:39901 |
| CONF-830583- | (American Association for the Advancement of Science annual meeting, Detroit, MI, USA, 26-31 May 1983) | | | |
| 1 | *See* PNL-SA-11346 | DE83011380 | MN -69 | 8:39446 |
| 2 | NTIS, PC A02/MF A01 | DE83012632 | MN -98E | 8:38871 |
| CONF-830584- | (American industrial hygiene conference, Philadelphia, PA, USA, 22-27 May 1983) | | | |
| 1 | *See* UCRL-89148 | DE83011896 | MN -41 | 8:39447 |
| CONF-830585- | (International committee for radionuclide seminar on applied radionuclide metrology, Gell, Belgium, 16-17 May 1983) | | | |
| 1 | *See* UCRL-89142 | DE83011902 | MN -4 | 8:39734 |
| CONF-830586- | (13. international data committee meeting, Rio de Janeiro, Brazil, 16-20 May 1983) | | | |
| 1 | *See* UCRL-89160 | DE83012940 | MN -21 | 8:39878 |
| CONF-830587- | (9. annual research symposium on land disposal, incineration and treatment of hazardous waste, Ft. Mitchell, KY, USA, 2-4 May 1983) | | | |
| 1 | *See* MLM-3071-(OP) | DE83012571 | MN -69 | 8:39346 |
| CONF-830588- | (Delta-Nucleus dynamics symposium, Argonne, IL, USA, 2-4 May 1983) | | | |
| 1 | *See* LA-UR-83-1397 | DE83012666 | MN -34C | 8:39600 |
| CONF-830589- | (10. National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCCHE) annual meeting, Knoxville, TN, USA, 25-28 May 1983) | | | |
| 1 | NTIS, PC A02/MF A01; 1 | DE83012631 | MN -20d | 8:39847 |
| CONF-830591- | (Polarized ion workshop, Vancouver, Canada, 23-28 May 1983) | | | |
| 1 | *See* LA-UR-83-1466 | DE83012781 | MN -28 | 8:39290 |
| CONF-830593- | (American Engineering Model Society seminar, San Diego, CA, USA, 3-6 May 1983) | | | |
| 1 | *See* SAND-83-1000C | DE83013466 | MN -21 | 8:39872 |
| CONF-830594- | (IEEE minicourse on RF heating and current drive, San Diego, CA, USA, 24-27 May 1983) | | | |
| 1 | *See* UCRL-89276 | DE83013378 | MN -20a | 8:39818 |
| CONF-830595- | (7. international conference on noise in physical systems, Montpellier, France, 16-20 May 1983) | | | |
| 1 | *See* LBL-16127 | DE83013686 | MN -34 | 8:39236 |
| CONF-830596- | (Seismological Society of America meeting, Salt Lake City, UT, USA, 2-4 May 1983) | | | |
| 1 | *See* RHO-BW-SA-289-P | DE83013478 | MN -70 | 8:39458 |
| CONF-830597- | (NOAA meeting on ocean dumping - strategies and policies, Kingston, RI, USA, 2-6 May 1983) | | | |
| 1 | *See* PNL-SA-11332 | DE83013367 | MN -70B | 8:38548 |
| CONF-830598- | (RCNP symposium on light ion reaction mechanism, Osaka, Japan, 16-20 May 1983) | | | |
| 1 | *See* DOE/ER/40048-54-L3 | DE83013489 | MN -34C | 8:39684 |
| CONF-830599- | (RCNP Kikuchi summer school, Kyoto, Japan, 23-27 May 1983) | | | |
| 1 | *See* DOE/ER/40048-55-L3 | DE83013243 | MN -34C | 8:39685 |
| CONF-8305100- | (4. Electrochemical Society international symposium on molten salts, Pennington, NJ, USA, 8-13 May 1983) | | | |
| 1-Rev. | NTIS, PC A02/MF A01 | DE83011652 | MN -94cc | 8:38975 |
| CONF-830606- | (3. international conference on magagauss magnetic field generation and related topics, Novosibirsk, USSR, 13-17 Jun 1983) | | | |
| 10 | *See* SAND-83-1341C | DE83013640 | MN -20g | 8:39816 |
| CONF-830609- | (ANS annual meeting, Detroit, MI, USA, 12-17 Jun 1983) | | | |
| 14 | *See* SAND-83-0247C | DE83013472 | MN -41 | 8:38551 |
| 15 | *See* HEDL-SA-2805-FP | DE83013655 | MN -79g | 8:38940 |
| 16 | *See* HEDL-SA-2826-FP | DE83013713 | MN -79e | 8:38941 |
| 18 | *See* PNL-SA-11075 | DE83013756 | MN -80 | 8:38962 |
| CONF-830610- | (Nevada Applied Ecology Group transuranics (and associated radionuclides) information conference, Las Vegas, NV, USA, 28-30 Jun 1983) | | | |
| 1 | *See* PNL-SA-11423 | DE83013825 | MN -11 | 8:39367 |
| CONF-830611- | (Rapid excavation and tunneling conference, Chicago, IL, USA, 12-16 Jun 1983) | | | |
| 2 | *See* RHO-BW-SA-262P | DE83013812 | MN -70 | 8:39475 |

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|---|---|---|---|---|
| CONF-830615- | (ASME summer meeting, Houston, TX, USA, 20-22 Jun 1983) | | | |
| 4 | NTIS, PC A02/MF A01 | DE83003952 | MN -95d | 8:39037 |
| CONF-830621- | (IEEE power electronics specialists conference, Albuquerque, NM, USA, 6-9 Jun 1983) | | | |
| 2 | *See* SAND-83-0351C | DE83011784 | MN -21 | 8:39870 |
| 3 | *See* SAND-83-1007C | DE83012494 | MN -21 | 8:39873 |
| 5 | *See* SAND-83-0304C | DE83012623 | MN -21 | 8:39869 |
| 6 | *See* SAND-83-0019C | DE83012630 | MN -21 | 8:39866 |
| 8 | *See* SAND-83-1016C | DE83012636 | MN -21 | 8:39874 |
| 9 | *See* SAND-83-0219C | DE83012873 | MN -35 | 8:39016 |
| 12 | *See* SAND-83-0544C | DE83012871 | MN -21 | 8:39871 |
| 15 | *See* LA-UR-83-1435 | DE83012784 | MN -38 | 8:39856 |
| 16 | *See* SAND-83-0333C | DE83013675 | MN -38 | 8:39246 |
| 18 | *See* SAND-83-0046C | DE83013677 | MN -38 | 8:39243 |
| 19 | *See* SAND-83-0121C | DE83013643 | MN -38 | 8:39244 |
| 20 | *See* SAND-82-2732C | DE83013633 | MN -21 | 8:39865 |
| 21 | *See* SAND-83-0270C | DE83013632 | MN -21 | 8:39868 |
| 22 | *See* SAND-83-0808C | DE83013676 | MN -38 | 8:39247 |
| 23 | *See* SAND-83-0228C | DE83013769 | MN -38 | 8:39245 |
| 24 | *See* UCRL-88665 | DE83013793 | MN -21 | 8:39877 |
| 25 | *See* UCRL-88624 | DE83013859 | MN -38 | 8:39250 |
| 26 | *See* SAND-83-0108C | DE83013641 | MN -21 | 8:39867 |
| CONF-830622- | (American Solar Energy Society meeting, Minneapolis, MN, USA, 1-3 Jun 1983) | | | |
| 13 | *See* SERI/TP-211-1984 | DE83011960 | STD -60 | 8:38868 |
| 14 | *See* SERI/TP-211-1978 | DE83011963 | STD -60 | 8:38867 |
| 15 | *See* SERI/TP-211-1990 | DE83011958 | STD -63 | 8:38687 |
| 16 | *See* PNL-SA-10999 | DE83013828 | MN -60 | 8:38864 |
| 17 | *See* SAN-20110-9 | DE83011834 | MN -59c | 8:38807 |
| 18 | *See* SERI/TP-211-1959 | DE83011957 | STD -63 | 8:38686 |
| CONF-830628- | (American control conference, San Francisco, CA, USA, 22-24 Jun 1983) | | | |
| 5 | *See* SAND-83-0229 | DE83011795 | MN -32 | 8:39898 |
| CONF-830631- | (6. biennial wind energy conference, Minneapolis, MN, USA, 1-3 Jun 1983) | | | |
| 7 | *See* SAND-82-2504C | DE83013751 | MN -60 | 8:38866 |
| 8 | *See* PNL-SA-10994 | DE83013836 | MN -60 | 8:38863 |
| 9 | *See* PNL-SA-11172 | DE83013823 | MN -60 | 8:38865 |
| CONF-830637- | (IEEE international symposium on applications of ferroelectrics, Gaithersburg, MD, USA, 1-3 Jun 1983) | | | |
| 3 | *See* SAND-83-1260C | DE83012628 | MN -38 | 8:39122 |
| 4 | *See* SAND-83-1279C | DE83013311 | MN -34 | 8:39140 |
| CONF-830639- | (12. transaducer workshop, Melbourne, FL, USA, 7-9 Jun 1983) | | | |
| 1 | *See* SAND-82-1730C | DE83011499 | MN -38 | 8:39319 |
| 3 | *See* EGG-10282-1018 | DE83012750 | MN -38 | 8:39316 |
| 4 | *See* SAND-82-1877C | DE83012635 | MN -38 | 8:39320 |
| CONF-830642- | (5. international workshop on gases in strong rotation, Charlottesville, VA, USA, 6-9 Jun 1983) | | | |
| 2 | *See* K/CSD/INF-83/3 | DE83013011 | MN -22 | 8:38491 |
| CONF-830643- | (3. biennial synfuels wastewater workshop, Morgantown, WV, USA, 15-16 Jun 1983) | | | |
| 1 | *See* DOE/FE/60181-15 | DE83013087 | MN -90 | 8:38342 |
| CONF-830644- | (Nuclear Energy Agency workshop on experimental methodologies in radionuclide sorption, Paris, France, 6-7 Jun 1983) | | | |
| 1 | *See* UCRL-89210 | DE83012694 | MN -11 | 8:39369 |
| CONF-830646- | (Optogalvanic spectroscopy and application meeting, Aussois, France, 20-25 Jun 1983) | | | |
| 1 | *See* UCRL-88533 | DE83013583 | MN -22 | 8:39521 |
| CONF-830647- | (SIAM conference on the application of discrete mathematics, Cambridge, MA, USA, 27-29 Jun 1983) | | | |
| 1 | *See* SAND-1304C | DE83013671 | MN -32 | 8:39900 |
| CONF-830648- | (International conference on monofluorophosphate, Boston, MA, USA, 9-10 Jun 1983) | | | |
| 1 | *See* DOE/EV/03490-2301 | DE83013010 | MN -48 | 8:39440 |
| CONF-830649- | (2. international corbicula symposium, Hot Springs, AR, USA, 21-24 Jun 1983) | | | |
| 1 | *See* DPSPU-82-30-15 | DE83012581 | MN -78 | 8:38917 |
| CONF-830650- | (FRG/US workshop on size reduction and decontamination facilities, Karlsruhe, F.R. Germany, 27-30 Jun 1983) | | | |
| 1 | *See* DP-MS-83-55 | DE83013340 | MN -2 | 8:38534 |
| CONF-830702- | (21. ASME/AIChE national heat transfer conference, Seattle, WA, USA, 24-28 Jul 1983) | | | |
| 19 | *See* DOE/FE/60181-16 | DE83013246 | MN -90 | 8:38416 |
| CONF-830704- | (9. international colloquium on dynamics of explosions and reactive systems, Poitier, France, 3-8 Jul 1983) | | | |
| 4 | *See* SAND-83-1147C | DE83013097 | MN -35 | 8:39333 |
| CONF-830705- | (IEEE Power Engineering Society summer meeting, Los Angeles, CA, USA, 17-22 Jul 1983) | | | |
| 2 | *See* SAND-83-1308C | DE83013465 | MN -38 | 8:39272 |
| CONF-830709- | (24. annual meeting of the Institute of Nuclear Materials Management, Vail, CO, USA, 10-13 Jul 1983) | | | |
| 7 | *See* K/OA-5261 | DE83013567 | MN -15 | 8:38572 |

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|---|---|---|---|---|
| CONF-830756- | (6. international zeolite conference, Reno, NV, USA, 10-15 Jul 1983) | | | |
| 4 | *See* DPST-83-248 | DE83012203 | MN -78 | 8:38905 |
| CONF-830757- | (IUTAM-IUPAP symposium on the mechanical behaviour of electromagnetic solid continua, Paris, France, 4-7 Jul 1983) | | | |
| 1 | *See* SAND-83-0407C | DE83012872 | MN -25 | 8:39736 |
| CONF-830759- | (16. annual technical meeting of the International Metallographic Society, Calgary, Canada, 25-28 Jul 1983) | | | |
| 1 | *See* UCRL-89378 | DE83013581 | MN -32 | 8:39271 |
| CONF-830812- | (18. intersociety energy conversion engineering conference, Orlando, FL, USA, 21-26 Aug 1983) | | | |
| 25 | *See* DOE/NASA/1005-1 | DE83013343 | STD -95 | 8:39074 |
| COO- | | | | |
| 2009-146 | *See* DOE/ER/02009-T5 | DE83013341 | MN -34D | 8:39549 |
| 2218-251 | *See* DOE/ET/52040-T9 | DE83013392 | MN -20 | 8:39779 |
| 2218-272 | *See* DOE/ET/52040-T13 | DE83013014 | MN -20 | 8:39852 |
| 2383-0092 | *See* DOE/ER/02383-T5 | DE83013431 | MN -32 | 8:39891 |
| 3419-24 | *See* DOE/EV/03419-T3 | DE83012395 | MN -48 | 8:39417 |
| CSS/CI- | | | | |
| 83-04 | NTIS, PC A03/MF A01 | DE83012285 | MN -90i | 8:38411 |
| 83-05 | Kansas State University, Manhattan, KS 66506 | DE83902099 | MN -11 | 8:39342 |
| 83-07 | Carnegie-Mellon Univ., Dept. of Mechanical Engineering, Pittsburgh, PA 15213 | | MN -90c | 8:38337 |
| 83-08 | Univ. of Pennsylvania, Department of Chemical Engineering, Philadelphia, PA | | MN -90e | 8:38412 |
| 83-09 | The Combustion Inst., Central State Section, P.O. Drw. 28510, San Antonio, TX 78284 | | MN -90i | 8:38413 |
| 83-13 | Combustion Institute, Central States Section, P.O. No. 28510, San Antonio, TX 78284 | | MN -90e | 8:38414 |
| 83-16 | University of Wisconsin, Dept. of Mechanical Engineering, Madison, WI 53706 | | MN -61a | 8:38600 |
| 83-17 | NTIS (US Sales Only), PC A02/MF A01 | DE83902033 | MN -61a | 8:38601 |
| 83-19 | Purdue Univ., School of Mechanical Engineering, Thermal Sciences and Propulsion Center, The Combustion Lab., West Lafayette, IN 47907 | | MN -93 | 8:39069 |
| 83-20 | Purdue Univ., School of Mechanical Engineering, Thermal Sciences and Propulsion Center, The Combustion Lab., West Lafayette, IN 47907 | | MN -38 | 8:39279 |
| 83-21 | Purdue University, The Combustion Lab., West Lafayette, IN | | MN -96 | 8:39070 |
| 83-22 | The Combustion Inst., Central States Section, P.O. Drawer 28510, San Antonio, TX 78284 | | MN -96 | 8:39077 |
| 83-23 | Purdue University, Thermal Sciences and Propulsion Center, The Combustion Lab., West Lafayette, IN | | MN -92b | 8:39226 |
| CTO- | | | | |
| 2117 | NTIS (US Sales Only), PC A02/MF A01 | DE83902258 | MN -20 | 8:39885 |
| DESY- | | | | |
| 82-053(Rev.Ext.Ed.) | NTIS (US Sales Only), PC A02/MF A01 | DE83750674 | MN -34D | 8:39610 |
| 82-076 | NTIS (US Sales Only), PC A02/MF A01 | DE83750670 | MN -28 | 8:39300 |
| 82-077 | NTIS (US Sales Only), PC A05/MF A01 | DE83750673 | MN -34D | 8:39548 |
| 82-082 | NTIS (US Sales Only), PC A02/MF A01 | DE83750671 | MN -34D | 8:39619 |
| 82-083 | NTIS (US Sales Only), PC A02/MF A01 | DE83750672 | MN -34D | 8:39533 |
| DOE/AL/10563- | | | | |
| T17 | NTIS, PC A03/MF A01 | DE83011297 | STD -66a | 8:38849 |
| DOE/AL/10752- | | | | |
| 23 | NTIS, PC A08/MF A01; 1 | DE83012889 | MN -70 | 8:38565 |
| DOE/ARS- | | | | |
| 7315-20741/ 83/ 1 | NTIS, PC A08/MF A01; 1 | DE83013438 | STD -60 | 8:38857 |
| DOE/BC/10331- | | | | |
| 9 | NTIS, PC A06/MF A01 | DE83013815 | STD -92a | 8:38443 |
| DOE/BC/10525- | | | | |
| 4 | NTIS, PC A05/MF A01 | DE83013819 | STD -91 | 8:38475 |
| DOE/BP- | | | | |
| 151-Vol.1 | NTIS, PC A19/MF A01; 1 | DE83012908 | MN -97d | 8:38872 |
| 151-Vol.2 | NTIS, PC A14/MF A01; 1 | DE83012909 | MN -97d | 8:38853 |
| DOE/CE/15084- | | | | |
| T1 | NTIS MF A01; 2 | DE83012415 | MN -95f | 8:39055 |
| DOE/CE/15100- | | | | |
| T1 | NTIS, PC A03/MF A01; 1 | DE83013474 | MN -95 | 8:39038 |
| DOE/CH/00016- | | | | |
| T2 | NTIS, PC A05/MF A01; 1 | DE83013874 | MN -66c | 8:38850 |
| DOE/CS/10044- | | | | |
| T1 | NTIS, PC A04/MF A01 | DE83013239 | MN -95 | 8:39026 |
| T3 | NTIS, PC A04/MF A01 | DE83012456 | MN -95 | 8:39027 |
| DOE/CS/15072- | | | | |
| T4 | NTIS, PC A02/MF A01; 1 | DE83012936 | MN -62 | 8:38809 |
| DOE/CS/20420- | | | | |
| T1 | NTIS, PC A13/MF A01; 1 | DE83011923 | MN -95d | 8:39039 |
| T2 | NTIS, PC A07/MF A01; 1 | DE83012272 | MN -95d | 8:39040 |
| DOE/CS/25173- | | | | |
| T1 | NTIS, PC A08/MF A01; 1 | DE83012388 | MN -95d | 8:39041 |
| DOE/CS/30228- | | | | |
| T1 | NTIS, PC A08/MF A01; 1 | DE83012741 | STD -59a | 8:38802 |
| DOE/CS/30363- | | | | |
| T1 | NTIS, PC A04/MF A01; 1 | DE83013386 | MN -59 | 8:38803 |

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|---|---|---|---|---|
| DOE/CS/40071-24 | NTIS, PC A23/MF A01; 1 | DE83011048 | MN -95f | 8:38617 |
| DOE/CS/50209-T1 | NTIS, PC A04/MF A01 | DE83012973 | MN -96 | 8:39071 |
| DOE/CS/89004-T1 | NTIS, PC A09/MF A01 | DE83013333 | MN -58a | 8:38607 |
| DOE/DP-0015 | NTIS, PC A03/MF A01 | DE83013816 | MN -70 | 8:38525 |
| DOE/DP/40131-1 | NTIS, PC A05/MF A01; 1 | DE83013413 | MN -21 | 8:39848 |
| DOE/EI/19622-T1 | NTIS, PC A02/MF A01 | DE83013101 | MN -98B | 8:38998 |
| DOE/EIA-0035-(83/ 06) | NTIS, PC A06/MF A01 | DE83013944 | MN -98 | 8:39009 |
| 0044(81) | NTIS, PC A23/MF A01 | DE83013569 | MN -98E | 8:38873 |
| 0109-(83/ 06) | NTIS, PC A05/MF A01; 1 | DE83013942 | MN -98B | 8:38453 |
| 0172(81) | NTIS, PC A07/MF A01; 1 | DE83013369 | MN -98E | 8:38874 |
| 0174(82) | NTIS, PC A04/MF A01; 1 | DE83013840 | MN -98D | 8:38608 |
| 0206(81) | NTIS, PC A08/MF A01; 1 | DE83013566 | MN -98 | 8:38426 |
| 0214(81) S | NTIS, PC A05/MF A01; 1 | DE83013376 | MN -98 | 8:39010 |
| 0226(83/ 03) | NTIS, PC A03/MF A01; 1 | DE83013404 | MN -98E | 8:38875 |
| 0292(82) | NTIS, PC A13/MF A01; 1 | DE83013839 | MN -98B | 8:38454 |
| 0321-2 | NTIS, PC A13/MF A01 | DE83013590 | MN -98 | 8:39011 |
| 0340(82) / 1-Vol.1 | NTIS, PC A08/MF A01; 1 | DE83013570 | MN -92 | 8:38455 |
| DOE/EP-0088 | NTIS, PC A04/MF A01; 1 | DE83012960 | STD -41 | 8:38526 |
| DOE/ER-0168 | NTIS, PC A02/MF A01 | DE83013616 | MN -94cb | 8:38976 |
| DOE/ER/01198-1399 | NTIS, PC A07/MF A01 | DE83013433 | MN -34A | 8:39086 |
| 1400 | NTIS, PC A04/MF A01; 1 | DE83013430 | MN -25 | 8:39120 |
| T2 | NTIS, PC A05/MF A01 | DE83013651 | MN -25 | 8:39087 |
| DOE/ER/01545-334 | NTIS, PC A04/MF A01 | DE83012317 | MN -34D | 8:39612 |
| DOE/ER/02009-T5 | NTIS, PC A03/MF A01 | DE83013341 | MN -34D | 8:39549 |
| DOE/ER/02383-T5 | NTIS, PC A03/MF A01 | DE83013431 | MN -32 | 8:39891 |
| DOE/ER/05940-001 | NTIS, PC A02/MF A01; 1 | DE83012787 | MN -28 | 8:39283 |
| DOE/ER/06035-5 | NTIS, PC A03/MF A01 | DE83013349 | MN -25 | 8:39508 |
| DOE/ER/10004-5 | NTIS, PC A11/MF A01; 1 | DE83013652 | MN -13 | 8:39080 |
| DOE/ER/10340-T1 | NTIS, PC A02/MF A01; 1 | DE83013036 | MN -90d | 8:38338 |
| DOE/ER/10613-1 | NTIS, PC A02/MF A01 | DE83013054 | MN -20a | 8:39775 |
| DOE/ER/10699-T1 | NTIS, PC A03/MF A01; 1 | DE83012986 | MN -34D | 8:39304 |
| T2 | NTIS, PC A03/MF A01; 1 | DE83013613 | MN -34D | 8:39288 |
| DOE/ER/10715-3 | NTIS, PC A02/MF A01 | DE83013914 | MN -48 | 8:39394 |
| DOE/ER/10738-1 | NTIS, PC A03/MF A01 | DE83013634 | MN -4 | 8:38489 |
| DOE/ER/10936-2 | NTIS, PC A03/MF A01; 1 | DE83013733 | MN -4 | 8:39126 |
| DOE/ER/10968-T1 | NTIS, PC A02/MF A01; 1 | DE83012680 | MN -4 | 8:39191 |
| DOE/ER/14953-T2 | NTIS, PC A03/MF A01 | DE83006325 | MN -4 | 8:39158 |
| T3 | NTIS, PC A02/MF A01 | DE83006324 | MN -4 | 8:39159 |
| DOE/ER/40033-38 | NTIS, PC A02/MF A01 | DE83012981 | MN -34D | 8:39301 |
| DOE/ER/40048-53-L3 | NTIS, PC A10/MF A01; 1 | DE83012903 | MN -34A | 8:39509 |
| 54-L3 | NTIS, PC A02/MF A01; 1 | DE83013489 | MN -34C | 8:39684 |
| 55-L3 | NTIS, PC A03/MF A01; 1 | DE83013243 | MN -34C | 8:39685 |
| DOE/ER/51031-T1 | NTIS, PC A04/MF A01; 1 | DE83012745 | MN -20g | 8:39776 |
| DOE/ER/52074-T1 | NTIS MF A01; 2 | DE83002783 | MN -20b | 8:39849 |
| DOE/ER/52076-5 | NTIS, PC A03/MF A01; 1 | DE83013492 | MN -20d | 8:39777 |
| 6 | NTIS, PC A06/MF A01; 1 | DE83013493 | MN -20d | 8:39850 |
| DOE/ERD-0020 | NTIS, PC A03/MF A01; 1 | DE83013416 | STD -64 | 8:38771 |
| DOE/ET/4053-78/ 1(Exec.Summ.) | NTIS, PC A03/MF A01 | DE83013417 | STD -60 | 8:38856 |
| DOE/ET/10679-T17 | NTIS, PC A09/MF A01; 1 | DE83013544 | STD -90a | 8:38415 |
| DOE/ET/10815-91 | NTIS, PC A07/MF A01; 1 | DE83013208 | MN -90g | 8:39013 |
| DOE/ET/11304-25 | NTIS, PC A02/MF A01; 1 | DE83013564 | MN -93 | 8:39017 |

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| 26 | NTIS, PC A02/MF A01 | DE83013568 | MN -93 | 8:39018 |
| DOE/ET/11417-<br>18 | NTIS, PC A04/MF A01; 1 | DE83012863 | MN -90g | 8:39014 |
| DOE/ET/13333-<br>T2 | NTIS, PC A06/MF A01; 1 | DE83013610 | STD -61a | 8:38876 |
| DOE/ET/14700-<br>14 | NTIS, PC A05/MF A01 | DE83011316 | STD -90d | 8:38340 |
| DOE/ET/14746-<br>10 | NTIS MF A01; 2 | DE83011833 | STD -90c | 8:38378 |
| 12 | NTIS, PC A07/MF A01; 1 | DE83012508 | STD -90i | 8:38379 |
| DOE/ET/14880-<br>T3 | NTIS, PC A03/MF A01; 1 | DE83011222 | MN -90d | 8:38341 |
| DOE/ET/15492-<br>T40 | NTIS, PC A02/MF A01 | DE83013627 | MN -90i | 8:38376 |
| DOE/ET/20460-<br>3 | NTIS, PC A03/MF A01; 2 | DE83013418 | STD -63e | 8:38623 |
| DOE/ET/27059-<br>1 | NTIS, PC A15/MF A01; 1 | DE83013375 | STD -66d | 8:38851 |
| DOE/ET/28352-<br>T1 | NTIS, PC A03/MF A01; 1 | DE83012686 | MN -66b | 8:38825 |
| DOE/ET/29011-<br>T1 | NTIS, PC A14/MF A01; 1 | DE83013009 | MN -97a | 8:38888 |
| DOE/ET/29063-<br>T1 | NTIS, PC A23/MF A01; 1 | DE83003499 | MN -97a | 8:38889 |
| DOE/ET/29366-<br>T1 | NTIS MF A01; 2 | DE83013057 | MN -97 | 8:38890 |
| DOE/ET/51013-<br>83 | NTIS, PC A07/MF A01; 1 | DE83013854 | STD -20 | 8:39778 |
| DOE/ET/51015-<br>T5 | NTIS, PC A02/MF A01 | DE83013432 | MN -20b | 8:39851 |
| DOE/ET/52040-<br>T9 | NTIS, PC A05/MF A01; 1 | DE83013392 | MN -20 | 8:39779 |
| T13 | NTIS, PC A04/MF A01; 1 | DE83013014 | MN -20 | 8:39852 |
| DOE/ET/53036-<br>39 | NTIS, PC A02/MF A01 | DE83005632 | MN -20g | 8:39780 |
| DOE/ET/53051-<br>54 | NTIS, PC A03/MF A01 | DE83013543 | STD -20f | 8:39781 |
| 55 | NTIS, PC A03/MF A01 | DE83013532 | STD -20f | 8:39782 |
| DOE/ET/53088-<br>67 | NTIS, PC A03/MF A01 | DE83005667 | MN -20g | 8:39783 |
| DOE/EV/03221-<br>76 | NTIS, PC A02/MF A01; 1 | DE83013387 | MN -4 | 8:39217 |
| DOE/EV/03419-<br>T3 | NTIS, PC A02/MF A01 | DE83012395 | MN -48 | 8:39417 |
| DOE/EV/03490-<br>2284 | NTIS, PC A02/MF A01; 1 | DE83013219 | MN -48 | 8:39418 |
| 2301 | NTIS, PC A02/MF A01 | DE83013010 | MN -48 | 8:39440 |
| DOE/EV/04159-<br>1 | NTIS, PC A02/MF A01 | DE83013842 | MN -48 | 8:39404 |
| DOE/EV/10374-<br>3 | NTIS, PC A04/MF A01; 1 | DE83013008 | MN -11 | 8:39358 |
| DOE/EV/10403-<br>12 | NTIS, PC A03/MF A01; 1 | DE83013555 | MN -11 | 8:39343 |
| DOE/EV/70003-<br>16 | NTIS, PC A02/MF A01 | DE83013030 | MN -88 | 8:38396 |
| DOE/FE/60181-<br>15 | NTIS, PC A02/MF A01; 1 | DE83013087 | MN -90 | 8:38342 |
| 16 | NTIS, PC A02/MF A01; 1 | DE83013246 | MN -90 | 8:38416 |
| DOE/ID/12079-<br>88 | NTIS, PC A08/MF A01 | DE83013439 | MN -66a | 8:38814 |
| DOE/ID/12170-<br>T1 | NTIS, PC A12/MF A01; 1 | DE83013678 | MN -95f | 8:39056 |
| DOE/ID/12305-<br>T1 | NTIS, PC A04/MF A01; 1 | DE83013061 | MN -70B | 8:38527 |
| DOE/ID/12327-<br>T1 | NTIS, PC A03/MF A01 | DE83013488 | MN -61a | 8:38594 |
| DOE/ID/12337-<br>T1 | NTIS, PC A04/MF A01; 1 | DE83013073 | MN -61a | 8:38595 |
| DOE/ID/12339-<br>T1 | NTIS, PC A05/MF A01 | DE83013487 | MN -61a | 8:38596 |
| DOE/JPL-<br>1012-86 | NTIS, PC A08/MF A01 | DE83013950 | STD -63b | 8:38624 |
| DOE/JPL/956046-<br>83/ 5 | NTIS, PC A05/MF A01 | DE83013881 | STD -63b | 8:38625 |
| DOE/LC/10787-<br>115 | NTIS, PC A06/MF A01; 1 | DE83012970 | STD -91 | 8:38473 |
| DOE/LLW-<br>3 | NTIS, PC A10/MF A01 | DE83013941 | MN -70B | 8:38528 |
| 18T-Rev.1 | NTIS, PC A21/MF A01 | DE83013155 | STD -70B | 8:38529 |
| DOE/MC/14061-<br>1-Rev.1 | NTIS, PC A09/MF A01; 1 | DE83011473 | MN -90e | 8:38343 |
| DOE/MC/14705-<br>T5 | NTIS, PC A03/MF A01 | DE83011601 | MN -90c | 8:38344 |
| DOE/MC/16477-<br>1421 | NTIS, PC A11/MF A01; 1 | DE83013575 | STD -92a | 8:38345 |

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|---|---|---|---|---|
| DOE/MC/16551-6 | NTIS, PC A05/MF A01 | DE83013818 | STD -90a | 8:38444 |
| DOE/MC/19077-T1 | NTIS, PC A04/MF A01; 1 | DE83013442 | MN -93 | 8:39019 |
| T2 | NTIS, PC A03/MF A01 | DE83013511 | MN -93 | 8:39020 |
| DOE/MC/19301-2 | NTIS, PC A03/MF A01 | DE83013293 | MN -90c | 8:38346 |
| DOE/METC-83-65 | NTIS, PC A04/MF A01 | DE83013785 | STD -92 | 8:38463 |
| DOE/NASA/0008-79/6 | NTIS, PC A06/MF A01; 1 | DE83013285 | STD -96 | 8:39072 |
| DOE/NASA/0241-6 | NTIS, PC A03/MF A01 | DE83012979 | MN -93 | 8:39021 |
| DOE/NASA/1005-1 | NTIS, PC A02/MF A01 | DE83013343 | STD -95 | 8:39074 |
| DOE/NBB-0036 | NTIS, PC A05/MF A01 | DE83013972 | STD -11 | 8:39344 |
| DOE/NBM-3010334 | Plenum Press, 233 Spring Street, New York, NY 10013 | | | 8:39114 |
| 3012040 | NTIS, PC A02/MF A01 | DE83012040 | MN -25 | 8:39127 |
| 3012985 | NTIS, PC A03/MF A01 | DE83012985 | STD -92a | 8:38445 |
| DOE/NE-0048/2 | NTIS, PC A05/MF A01; 1 | DE83013729 | MN -80 | 8:38899 |
| DOE/NE/34101-T1 | NTIS MF A01; 2 | DE83012793 | MN -32 | 8:38898 |
| DOE/PC/30021-T12 | NTIS, PC A03/MF A01 | DE83012434 | STD -90d | 8:38584 |
| DOE/PC/30022-5 | NTIS, PC A03/MF A01 | DE83013801 | MN -90d | 8:38585 |
| DOE/PC/30075-13 | NTIS, PC A02/MF A01 | DE83012026 | MN -90d | 8:38347 |
| DOE/PC/30139-T3 | NTIS, PC A07/MF A01; 1 | DE83013822 | STD -90b | 8:38405 |
| DOE/PC/30228-T8 | NTIS, PC A02/MF A01 | DE83012277 | MN -90d | 8:38586 |
| T9 | NTIS, PC A02/MF A01; 1 | DE83012191 | MN -90d | 8:38587 |
| DOE/PC/40265-7 | NTIS, PC A03/MF A01 | DE83013058 | MN -90e | 8:38417 |
| DOE/PC/40270-4 | NTIS, PC A04/MF A01; 1 | DE83011447 | STD -90i | 8:38418 |
| DOE/PC/40272-T3 | NTIS, PC A05/MF A01 | DE83013132 | STD -90e | 8:39280 |
| DOE/PC/40784-FR-1 | NTIS, PC A04/MF A01 | DE83011434 | STD -90d | 8:38348 |
| FR-2 | NTIS, PC A03/MF A01 | DE83011435 | STD -90d | 8:38349 |
| DOE/PC/40786-5 | NTIS MF A01; 2 | DE83013759 | MN -90c | 8:38350 |
| DOE/PC/40787-8 | NTIS, PC A02/MF A01 | DE83012971 | MN -90d | 8:38351 |
| DOE/PC/40789-T6 | NTIS, PC A02/MF A01 | DE83013093 | MN -90i | 8:38365 |
| DOE/PC/40793-T7 | NTIS, PC A06/MF A01; 1 | DE83013420 | MN -90a | 8:38366 |
| DOE/PC/40796-6 | NTIS, PC A02/MF A01 | DE83013085 | MN -90e | 8:38419 |
| 7 | NTIS, PC A03/MF A01 | DE83013086 | MN -90e | 8:38420 |
| DOE/PC/40799-T6 | NTIS, PC A02/MF A01 | DE83011910 | MN -90d | 8:38352 |
| DOE/PC/40805-4 | NTIS, PC A02/MF A01 | DE83013605 | MN -90e | 8:39227 |
| DOE/PC/40807-T7 | NTIS, PC A03/MF A01; 1 | DE83013393 | MN -90b | 8:38406 |
| DOE/PC/41761-T2 | NTIS, PC A02/MF A01; 1 | DE83012734 | MN -90d | 8:38353 |
| DOE/PC/42692-T2 | NTIS, PC A03/MF A01; 1 | DE83012791 | MN -90i | 8:38430 |
| DOE/PC/50046-1 | NTIS, PC A04/MF A01 | DE83013477 | STD -90d | 8:38354 |
| DOE/PC/50261-T2 | NTIS, PC A03/MF A01 | DE83012341 | MN -90c | 8:38421 |
| DOE/PC/50266-3 | NTIS, PC A03/MF A01; 1 | DE83013586 | MN -90b | 8:38422 |
| DOE/PC/50786-4 | NTIS, PC A02/MF A01 | DE83012865 | MN -90d | 8:38355 |
| DOE/PC/50790-T1 | NTIS, PC A02/MF A01; 1 | DE83012275 | MN -90a | 8:38367 |
| T2 | NTIS, PC A02/MF A01; 1 | DE83012354 | MN -90a | 8:38368 |
| DOE/PC/50807-T2 | NTIS, PC A02/MF A01 | DE83011186 | MN -90a | 8:38369 |
| DOE/PC/50811-1 | NTIS, PC A02/MF A01 | DE83013069 | MN -90d | 8:38356 |
| T1 | NTIS, PC A02/MF A01 | DE83013125 | MN -90d | 8:38357 |
| DOE/PC/51252-T1 | NTIS, PC A03/MF A01; 1 | DE83011512 | MN -90d | 8:38358 |

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|---|---|---|---|---|
| DOE/PC/51260- | | | | |
| 1 | NTIS, PC A02/MF A01 | DE83013100 | MN -90i | 8:38380 |
| 2 | NTIS, PC A02/MF A01 | DE83013348 | MN -90i | 8:38381 |
| 3 | NTIS, PC A02/MF A01 | DE83012162 | MN -90i | 8:38382 |
| DOE/PE/70047- | | | | |
| T2 | NTIS, PC A06/MF A01; 1 | DE83013339 | MN -13 | 8:38609 |
| T3 | NTIS, PC A04/MF A01; 1 | DE83013875 | MN -13 | 8:39042 |
| T4 | NTIS, PC A04/MF A01 | DE83013876 | MN -13 | 8:38877 |
| T5 | NTIS, PC A08/MF A01; 1 | DE83013877 | MN -13 | 8:38610 |
| T6 | NTIS, PC A03/MF A01 | DE83013878 | MN -13 | 8:38981 |
| DOE/PE/70124- | | | | |
| T1 | NTIS, PC A03/MF A01 | DE83013636 | MN -98B | 8:38456 |
| T2 | NTIS, PC A04/MF A01; 1 | DE83013635 | MN -98B | 8:38457 |
| DOE/RA/01699- | | | | |
| 4 | NTIS, PC A13/MF A01; 1 | DE83013853 | STD -97e | 8:38604 |
| DOE/RA/23215- | | | | |
| 3 | NTIS, PC A02/MF A01; 1 | DE83013342 | STD -97e | 8:38605 |
| DOE/RA/50377- | | | | |
| 1 | NTIS MF A01; 2 | DE83013542 | STD -95e | 8:39063 |
| DOE/RG- | | | | |
| 0062 | NTIS, PC A03/MF A01; 1 | DE83013482 | MN -97 | 8:38878 |
| DOE/S- | | | | |
| 0019 | NTIS, PC A02/MF A01 | DE83012883 | MN -70 | 8:38530 |
| 0020 | NTIS, PC A04/MF A01 | DE83014080 | MN -70 | 8:38506 |
| DOE/SF/00012- | | | | |
| T17 | NTIS, PC A03/MF A01 | DE83012975 | MN -48 | 8:39399 |
| T18 | NTIS, PC A02/MF A01; 1 | DE83012976 | MN -48 | 8:39400 |
| DOE/SF/01424- | | | | |
| 48 | NTIS, PC A02/MF A01; 1 | DE83011439 | MN -92a | 8:38446 |
| DOE/SF/10761- | | | | |
| 3 | NTIS, PC A07/MF A01; 1 | DE83013820 | STD -92a | 8:38447 |
| DP- | | | | |
| 1646 | NTIS, PC A04/MF A01; 1 | DE83013805 | STD -11 | 8:39359 |
| 1647 | NTIS, PC A03/MF A01 | DE83013426 | STD -10 | 8:38501 |
| 1651 | NTIS, PC A02/MF A01 | DE83013424 | STD -11 | 8:39360 |
| 1654 | NTIS, PC A02/MF A01 | DE83013423 | STD -37 | 8:39305 |
| 1657 | NTIS, PC A02/MF A01 | DE83013804 | MN -10 | 8:38502 |
| DP-MS- | | | | |
| 82-104 | NTIS, PC A02/MF A01 | DE83013679 | MN -70B | 8:38531 |
| 83-10 | NTIS, PC A03/MF A01 | DE83013681 | MN -34C | 8:39698 |
| 83-17 | NTIS, PC A02/MF A01 | DE83013680 | MN -70 | 8:38532 |
| 83-30 | NTIS, PC A02/MF A01; 1 | DE83012414 | MN -70 | 8:38533 |
| 83-34 | NTIS, PC A02/MF A01 | DE83012199 | MN -32 | 8:39886 |
| 83-55 | NTIS, PC A02/MF A01; 1 | DE83013340 | MN -2 | 8:38534 |
| DPR- | | | | |
| 82-3 | NTIS (US Sales Only), PC A03/MF A01 | DE83702053 | MN -48 | 8:39419 |
| DPSPU- | | | | |
| 82-30-15 | NTIS, PC A02/MF A01; 1 | DE83012581 | MN -78 | 8:38917 |
| DPST- | | | | |
| 82-128-4 | NTIS, PC A02/MF A01 | DE83013473 | MN -23 | 8:38576 |
| 83-248 | NTIS, PC A02/MF A01 | DE83012203 | MN -78 | 8:38905 |
| DSE- | | | | |
| 4042-T4 | NTIS, PC A02/MF A01 | DE83013448 | MN -63e | 8:38626 |
| 23052-81/ 1 | NTIS, PC A06/MF A01; 1 | DE83012391 | MN -60 | 8:38858 |
| E- | | | | |
| 83-10062 | *See* N-8314571 | | | 8:39347 |
| 83-10066 | *See* N-8314575 | | | 8:38383 |
| 83-10074 | *See* N-8314583 | | | 8:39480 |
| 83-10120 | *See* N-8315790 | | | 8:39412 |
| 978 | *See* N-8314691 | | | 8:39237 |
| ECN- | | | | |
| 82-159 | Stichting Energieonderzoek Centrum, Petten, Netherlands | | MN -38 | 8:39235 |
| 82-178 | Stichting Energieonderzoek Centrum Nederland, Petten | | ND -60 | 8:38859 |
| 82-188 | Stichting Energieonderzoek Centrum Nederland, Petten | | ND -60 | 8:38860 |
| 83-008 | Stichting Energieonderzoek Centrum Nederland, Petten | | ND -60 | 8:38854 |
| 83-017 | Stichting Energieonderzoek Centrum Nederland, Petten | | ND -38 | 8:39230 |
| 83-019 | Stichting Energieonderzoek Centrum Nederland, Petten | | ND -60 | 8:38861 |
| 83-047 | Available from ECN, P.O. Box 1, 1755 ZG Petten, Netherlands | | | 8:38385 |
| 83-056 | Available from ECN, P.O. Box 1, 1755 ZG Petten, Netherlands | | | 8:38869 |
| 83-062 | Available from ECN, P.O. Box 1, 1755 ZG Petten, Netherlands | | | 8:38425 |
| 118 | NTIS (US Sales Only), PC A07/MF A01 | DE83701646 | MN -34A | 8:39088 |
| 133 | NTIS (US Sales Only), PC A03/MF A01; 1 | DE83750934 | MN -90e | 8:38370 |
| EEG- | | | | |
| 23 | *See* DOE/AL/10752-23 | DE83012889 | MN -70 | 8:38565 |
| EGG- | | | | |
| 2263 | NTIS, PC A05/MF A01; 1 | DE83013837 | MN -70 | 8:38535 |
| 10282-1018 | NTIS, PC A02/MF A01; 1 | DE83012750 | MN -38 | 8:39316 |
| EGG-EA- | | | | |
| 5485(83) | *See* NUREG/CR-2770 | DE83008729 | MN -80 | 8:38901 |
| EGG-ELS- | | | | |
| 6177 | NTIS, PC A03/MF A01 | DE83013784 | MN -61a | 8:38627 |

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|---|---|---|---|---|
| **EGG-FT-** | | | | |
| 6277 | NTIS, PC A02/MF A01 | DE83013374 | MN -20c | 8:39853 |
| **EGG-M-** | | | | |
| 02183 | NTIS, PC A02/MF A01 | DE83013667 | MN -78 | 8:38945 |
| 03783 | NTIS, PC A03/MF A01 | DE83013666 | MN -78 | 8:38946 |
| 04483 | NTIS, PC A02/MF A01 | DE83013665 | MN -78 | 8:38947 |
| 04583 | NTIS, PC A02/MF A01 | DE83013518 | MN -80 | 8:38933 |
| 06983 | NTIS, PC A03/MF A01; 1 | DE83013673 | MN -78 | 8:38948 |
| 19782 | NTIS, PC A02/MF A01; 1 | DE83013537 | MN -38 | 8:39231 |
| 27882 | NTIS, PC A02/MF A01 | DE83013519 | MN -80 | 8:38934 |
| 30382 | NTIS, PC A02/MF A01 | DE83013664 | MN -80 | 8:38938 |
| **EGG-REP-** | | | | |
| 6273 | NTIS, PC A07/MF A01 | DE83013331 | MN -13 | 8:38939 |
| **EGG-TF-** | | | | |
| 6236 | NTIS, PC A03/MF A01 | DE83013788 | MN -69 | 8:39372 |
| **EPA-** | | | | |
| 600/ D-82-333 | Environmental Protection Agency, Corvallis, OR 97333 | | MN -11 | 8:39375 |
| **EPRI-AP-** | | | | |
| 3019 | NTIS, PC A08/MF A01; 1 | DE83902306 | MN -38 | 8:39282 |
| **EPRI-CS-** | | | | |
| 2961 | NTIS, PC A05/MF A01 | DE83902340 | MN -97 | 8:38879 |
| **EPRI-EA-** | | | | |
| 1498-Vol.3 | NTIS, PC A06/MF A01 | DE83014088 | MN -11 | 8:39345 |
| **EPRI-EL-** | | | | |
| 2561-Vol.4 | NTIS, PC A20/MF A01 | DE83902343 | MN -97d | 8:38880 |
| 3001 | NTIS, PC A08/MF A01; 1 | DE83902305 | MN -97 | 8:38881 |
| 3011 | NTIS, PC A03/MF A01 | DE83902331 | MN -97a | 8:38891 |
| 3014 | NTIS, PC A07/MF A01 | DE83902332 | MN -97a | 8:38892 |
| 3085 | NTIS PC E12/MF A01 | DE83902342 | MN -97b | 8:38893 |
| 3088 | NTIS, PC A06/MF A01 | DE83902266 | MN -97c | 8:38894 |
| **EPRI-EM-** | | | | |
| 2991 | NTIS, PC A04/MF A01 | DE83902333 | MN -97b | 8:38882 |
| 3092-SY | NTIS, PC A03/MF A01 | DE83902642 | MN -59a | 8:38611 |
| **EPRI-NP-** | | | | |
| 2542 | *See* NUREG/CR-2786 | DE83902098 | MN -78 | 8:38957 |
| 2631-SY | NTIS, PC A04/MF A01; 1 | DE83902198 | MN -15 | 8:38571 |
| 2978 | NTIS, PC A16/MF A01; 1 | DE83902313 | MN -78 | 8:38906 |
| 3024 | NTIS, PC A02/MF A01 | DE83902194 | MN -80 | 8:38907 |
| 3053 | NTIS, PC A05/MF A01 | DE83902293 | MN -78 | 8:38908 |
| 3059 | NTIS, PC A03/MF A01 | DE83014086 | MN -80 | 8:38909 |
| 3086 | NTIS, PC A08/MF A01; 1 | DE83902250 | MN -78 | 8:38949 |
| 3097 | NTIS, PC A05/MF A01 | DE83902277 | MN -85 | 8:38910 |
| 3107 | NTIS, PC A05/MF A01 | DE83902199 | MN -78 | 8:38911 |
| 3112 | NTIS, PC A05/MF A01; 1 | DE83902226 | MN -70B | 8:38536 |
| 3117 | NTIS, PC A06/MF A01 | DE83902196 | MN -70B | 8:38936 |
| **EPRI-RA-** | | | | |
| 2732-SR | NTIS, PC A15/MF A01; 1 | DE83902326 | MN -13 | 8:38987 |
| **ESA-SP-** | | | | |
| 1736 | *See* N-8314694 | | | 8:38717 |
| **ESC-WR-** | | | | |
| 82-26 | Stichting Energieonderzoek Centrum Nederland, Petten | | ND -60 | 8:39004 |
| 83-01 | Stichting Energieonderzoek Centrum Nederland, Petten | | ND -95f | 8:39057 |
| 83-04 | Stichting Energieonderzoek Centrum Nederland, Petten | | ND -95d | 8:39043 |
| **ESL-** | | | | |
| 107 | *See* DOE/ID/12079-88 | DE83013439 | MN -66a | 8:38814 |
| **EUR-** | | | | |
| 7703-EN | Commission of the European Communities, Luxembourg | | | 8:38974 |
| 7844-e | Commission of the European Communities, Luxembourg | | | 8:38423 |
| 7850-f | Commission of the European Communities, Luxembourg | | | 8:38371 |
| 7869-f | Commission of the European Communities, Luxembourg | | | 8:38397 |
| **EUR-CEA-FC-** | | | | |
| 1130 | NTIS (US Sales Only), PC A05/MF A01 | DE83701656 | MN -20 | 8:39784 |
| 1141 | NTIS (US Sales Only), PC A02/MF A01 | DE83701917 | MN -20 | 8:39785 |
| 1148 | NTIS (US Sales Only), PC A03/MF A01 | DE83701657 | MN -20 | 8:39786 |
| 1149 | NTIS (US Sales Only), PC A11/MF A01 | DE83701658 | MN -20 | 8:39787 |
| 1153 | NTIS (US Sales Only), PC A03/MF A01 | DE83701918 | MN -20 | 8:39788 |
| 1154 | NTIS (US Sales Only), PC A02/MF A01 | DE83701919 | MN -20 | 8:39789 |
| 1157 | NTIS (US Sales Only), PC A03/MF A01 | DE83701920 | MN -20 | 8:39790 |
| 1158 | NTIS (US Sales Only), PC A03/MF A01 | DE83701921 | MN -20 | 8:39791 |
| 1160 | NTIS (US Sales Only), PC A03/MF A01 | DE83701922 | MN -20 | 8:39792 |
| 1161 | NTIS (US Sales Only), PC A02/MF A01 | DE83701923 | MN -20 | 8:39793 |
| **FE-** | | | | |
| 1806-59 | NTIS, PC A09/MF A01 | DE83013503 | STD -90f | 8:38883 |
| 2248-21 | NTIS MF A01; 2 | DE83013504 | STD -90g | 8:39015 |
| 2465-9 | NTIS, PC A05/MF A01; 1 | DE83013505 | STD -90f | 8:38884 |
| 2468-103 | *See* DOE/ET/10679-T17 | DE83013544 | STD -90a | 8:38415 |
| 2517-3 | NTIS, PC A03/MF A01 | DE83013455 | MN -13 | 8:38982 |
| 2517-4 | NTIS, PC A03/MF A01; 1 | DE83013456 | MN -89 | 8:38427 |
| 2549-T2 | NTIS, PC A03/MF A01 | DE83013506 | STD -90e | 8:39058 |
| 3048-1 | NTIS, PC A03/MF A01 | DE83013507 | STD -90d | 8:38359 |
| 3242-5 | NTIS, PC A03/MF A01 | DE83013508 | STD -90e | 8:38407 |
| 4528-T1(Vol.2) | NTIS, PC A14/MF A01 | DE83013414 | STD -95d | 8:39044 |
| **FEI-** | | | | |
| 1260 | NTIS (US Sales Only), PC A03/MF A01 | DE83701996 | MN -34C | 8:39710 |
| 1297 | NTIS (US Sales Only), PC A02/MF A01 | DE83701947 | MN -34A | 8:39524 |

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| 1298 | NTIS (US Sales Only), PC A02/MF A01 | DE83701948 | MN -34A | 8:39525 |
| 1311 | NTIS (US Sales Only), PC A02/MF A01 | DE83701903 | MN -34A | 8:39089 |
| **FERMILAB-CONF-** | | | | |
| 83/ 35-Thy | NTIS, PC A02/MF A01 | DE83013846 | MN -34C | 8:39530 |
| **GA-A-** | | | | |
| 17031 | NTIS, PC A05/MF A01 | DE83013427 | STD -20f | 8:39794 |
| 17121 | NTIS, PC A02/MF A01 | DE83013682 | MN -71 | 8:38507 |
| **GAO/AFMD-** | | | | |
| 83-38 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -13 | 8:38988 |
| **GAO/EMD-** | | | | |
| 82-80 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -97a | 8:38895 |
| 82-130 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -92 | 8:38999 |
| **GAO/ID-** | | | | |
| 82-57 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -13 | 8:39012 |
| **GAO/PLRD-** | | | | |
| 82-33 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD | | MN -13 | 8:39887 |
| 83-12 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -13 | 8:39000 |
| **GAO/RCED-** | | | | |
| 83-2 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -13 | 8:38983 |
| 83-8 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -13 | 8:38612 |
| 83-52 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -13 | 8:38996 |
| 83-64 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -98E | 8:38885 |
| 83-75 | U.S. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -11 | 8:38997 |
| 83-84 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD | | MN -13 | 8:38925 |
| 83-87 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -78 | 8:38915 |
| 83-95 | General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760 | | MN -92 | 8:39001 |
| **GE-** | | | | |
| 3114-T2 | NTIS, PC A05/MF A01 | DE83013447 | STD -66j | 8:38844 |
| **GEAP-** | | | | |
| 22150 | *See* NUREG/CR-2786 | DE83902098 | MN -78 | 8:38957 |
| **GEPP-TIS-** | | | | |
| 532a | NTIS, PC A03/MF A01 | DE83013646 | MN -13 | 8:39526 |
| **GRS-** | | | | |
| 50 | NTIS (US Sales Only), PC A04/MF A01 | DE83750675 | MN -2 | 8:39905 |
| **GSCan-P-** | | | | |
| 81-1B | NTIS (US Sales Only), PC A09/MF A01 | DE83780699 | MN -4 | 8:39455 |
| 81-1C | NTIS (US Sales Only), PC A07/MF A01 | DE83780700 | MN -11 | 8:39456 |
| **HDL-TR-** | | | | |
| 82-1 | *See* AD-A-124125/6 | | | 8:39314 |
| **HEDL-SA-** | | | | |
| 2638 | NTIS, PC A03/MF A01 | DE83012822 | MN -38 | 8:38918 |
| 2687-A | NTIS, PC A02/MF A01; 1 | DE83012717 | MN -20c | 8:39090 |
| 2794-FP | NTIS, PC A02/MF A01 | DE83012825 | MN -85 | 8:38508 |
| 2796-FP | NTIS, PC A02/MF A01 | DE83012154 | MN -25 | 8:39268 |
| 2805-FP | NTIS, PC A02/MF A01 | DE83013655 | MN -79g | 8:38940 |
| 2824-FP | NTIS, PC A02/MF A01 | DE83012150 | MN -13 | 8:39888 |
| 2826-FP | NTIS, PC A02/MF A01 | DE83013713 | MN -79e | 8:38941 |
| 2871-FP | NTIS, PC A02/MF A01 | DE83012156 | MN -4 | 8:39148 |
| 2885-FP | NTIS, PC A02/MF A01; 1 | DE83012826 | MN -79a | 8:38942 |
| **HMI-B-** | | | | |
| 370 | NTIS (US Sales Only), PC A10/MF A01; 1 | DE83902388 | MN -34 | 8:39128 |
| **IAE-** | | | | |
| 3295/ 9 | NTIS (US Sales Only), PC A02/MF A01 | DE83701904 | MN -34A | 8:39510 |
| 3422/ 10 | NTIS (US Sales Only), PC A02/MF A01 | DE83701949 | MN -34A | 8:39091 |
| 3452/ 7 | NTIS (US Sales Only), PC A03/MF A01 | DE83701924 | MN -20 | 8:39795 |
| 3456/ 2 | NTIS (US Sales Only), PC A02/MF A01 | DE83701997 | MN -34C | 8:39711 |
| 3460/ 2 | NTIS (US Sales Only), PC A03/MF A01 | DE83702021 | MN -34C | 8:39666 |
| 3464/ 7 | NTIS (US Sales Only), PC A03/MF A01 | DE83701925 | MN -20 | 8:39796 |
| 3476/ 2 | NTIS (US Sales Only), PC A02/MF A01 | DE83702022 | MN -34C | 8:39699 |
| 3479/ 6 | NTIS (US Sales Only), PC A02/MF A01 | DE83701926 | MN -20 | 8:39797 |
| 3493/ 10 | NTIS (US Sales Only), PC A02/MF A01 | DE83701950 | MN -34A | 8:39741 |
| 3494/ 6 | NTIS (US Sales Only), PC A02/MF A01 | DE83701895 | MN -34A | 8:39511 |
| 3495/ 6 | NTIS (US Sales Only), PC A03/MF A01 | DE83701927 | MN -20 | 8:39798 |
| 3499/ 6 | NTIS (US Sales Only), PC A03/MF A01 | DE83701928 | MN -20 | 8:39799 |
| 3505/ 6 | NTIS (US Sales Only), PC A02/MF A01 | DE83701929 | MN -20 | 8:39800 |
| 3512/ 6 | NTIS (US Sales Only), PC A02/MF A01 | DE83701930 | MN -20 | 8:39801 |
| 3514/ 4 | NTIS (US Sales Only), PC A02/MF A01 | DE83701931 | MN -20 | 8:39802 |
| **IAEA-CN-** | | | | |
| 43/ 279 | *See* PNL-SA-10694 | DE83013260 | MN -70 | 8:38546 |
| **IAEA-R-** | | | | |
| 1446-F | NTIS (US Sales Only), PC A02/MF A01 | DE83701647 | MN -34A | 8:39160 |

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|---|---|---|---|---|
| 1525-F | NTIS (US Sales Only), PC A03/MF A01 | DE83702064 | MN -48 | 8:39420 |
| 1773-F | NTIS (US Sales Only), PC A04/MF A01 | DE83702051 | MN -48 | 8:39421 |
| 1777-F | NTIS (US Sales Only), PC A02/MF A01 | DE83702052 | MN -48 | 8:39422 |
| 1781-F | NTIS (US Sales Only), PC A02/MF A01 | DE83702049 | MN -48 | 8:39423 |
| 1804-F | NTIS (US Sales Only), PC A03/MF A01 | DE83702060 | MN -48 | 8:39410 |
| 2088-F | NTIS (US Sales Only), PC A02/MF A01 | DE83702061 | MN -48 | 8:39441 |
| 2153-F | NTIS (US Sales Only), PC A02/MF A01 | DE83702062 | MN -48 | 8:39442 |
| 2408-F | NTIS (US Sales Only), PC A03/MF A01 | DE83702065 | MN -48 | 8:39424 |
| 2495-F | NTIS (US Sales Only), PC A03/MF A01 | DE83702066 | MN -48 | 8:39425 |
| 2500-F | NTIS (US Sales Only), PC A02/MF A01 | DE83702063 | MN -48 | 8:39411 |
| 2615-F | NTIS (US Sales Only), PC A03/MF A01 | DE83702067 | MN -23 | 8:39426 |
| **IAEA-SM-** | | | | |
| 257 | Vienna, Austrai; International Atomic Energy Agency (1982). | | | 8:38564 |
| **IAEA-TECDOC-** | | | | |
| 255 | NTIS (US Sales Only), PC A03/MF A01 | DE83702057 | MN -48 | 8:39427 |
| 258 | NTIS (US Sales Only), PC A03/MF A01 | DE83702068 | MN -23 | 8:39429 |
| **IC-** | | | | |
| 80/ 89 | NTIS (US Sales Only), PC A02/MF A01 | DE83701632 | MN -34D | 8:39620 |
| 80/ 95 | NTIS (US Sales Only), PC A02/MF A01 | DE83701633 | MN -34D | 8:39621 |
| 80/ 96 | NTIS (US Sales Only), PC A02/MF A01 | DE83701679 | MN -34D | 8:39551 |
| 80/ 105 | NTIS (US Sales Only), PC A02/MF A01 | DE83701624 | MN -34D | 8:39552 |
| 80/ 110 | NTIS (US Sales Only), PC A02/MF A01 | DE83701625 | MN -34D | 8:39553 |
| 80/ 112 | NTIS (US Sales Only), PC A02/MF A01 | DE83701671 | MN -34D | 8:39622 |
| 80/ 133 | NTIS (US Sales Only), PC A02/MF A01 | DE83701626 | MN -34D | 8:39554 |
| 80/ 149 | NTIS (US Sales Only), PC A02/MF A01 | DE83701672 | MN -34D | 8:39712 |
| 80/ 161 | NTIS (US Sales Only), PC A02/MF A01 | DE83701673 | MN -34D | 8:39555 |
| 80/ 164 | NTIS (US Sales Only), PC A03/MF A01 | DE83701627 | MN -34D | 8:39623 |
| 80/ 167 | NTIS (US Sales Only), PC A03/MF A01 | DE83701628 | MN -34D | 8:39624 |
| 80/ 168 | NTIS (US Sales Only), PC A03/MF A01 | DE83701674 | MN -34D | 8:39556 |
| 80/ 169 | NTIS (US Sales Only), PC A02/MF A01 | DE83701675 | MN -34D | 8:39557 |
| 80/ 170 | NTIS (US Sales Only), PC A02/MF A01 | DE83701629 | MN -34D | 8:39613 |
| 80/ 175 | NTIS (US Sales Only), PC A02/MF A01 | DE83701676 | MN -34D | 8:39558 |
| 80/ 180 | NTIS (US Sales Only), PC A02/MF A01 | DE83701630 | MN -34D | 8:39559 |
| 80/ 183 | NTIS (US Sales Only), PC A03/MF A01 | DE83701677 | MN -34D | 8:39560 |
| 80/ 186 | NTIS (US Sales Only), PC A02/MF A01 | DE83701631 | MN -34D | 8:39561 |
| 80/ 190 | NTIS (US Sales Only), PC A04/MF A01 | DE83701678 | MN -34D | 8:39562 |
| 81/ 119 | NTIS (US Sales Only), PC A02/MF A01 | DE83701944 | MN -34B | 8:39486 |
| 81/ 136 | NTIS (US Sales Only), PC A03/MF A01 | DE83701634 | MN -34D | 8:39645 |
| 81/ 143 | NTIS (US Sales Only), PC A02/MF A01 | DE83701680 | MN -34D | 8:39563 |
| 81/ 155 | NTIS (US Sales Only), PC A03/MF A01 | DE83701635 | MN -34D | 8:39564 |
| 81/ 160 | NTIS (US Sales Only), PC A02/MF A01 | DE83701648 | MN -34A | 8:39093 |
| 81/ 169 | NTIS (US Sales Only), PC A02/MF A01 | DE83701636 | MN -34D | 8:39565 |
| 81/ 173 | NTIS (US Sales Only), PC A02/MF A01 | DE83701637 | MN -34D | 8:39625 |
| 81/ 177 | NTIS (US Sales Only), PC A02/MF A01 | DE83701638 | MN -34D | 8:39626 |
| 81/ 182 | NTIS (US Sales Only), PC A02/MF A01 | DE83701639 | MN -34D | 8:39627 |
| 81/ 198 | NTIS (US Sales Only), PC A02/MF A01 | DE83701649 | MN -34A | 8:39094 |
| 81/ 201 | NTIS (US Sales Only), PC A02/MF A01 | DE83701640 | MN -34D | 8:39614 |
| **IFSR-** | | | | |
| 67 | *See* DOE/ET/53088-67 | DE83005667 | MN -20g | 8:39783 |
| **IFU-B-** | | | | |
| 08-81 | Institut fuer Umweltforschung, Graz, Austria | | | 8:38804 |
| **IFVE-OEF-** | | | | |
| 82-98 | NTIS (US Sales Only), PC A02/MF A01 | DE83701984 | MN -34D | 8:39534 |
| **IFVE-OEIPK-** | | | | |
| 82-119 | NTIS (US Sales Only), PC A02/MF A01 | DE83701985 | MN -34D | 8:39535 |
| **IFVE-ONF-** | | | | |
| 81-98 | NTIS (US Sales Only), PC A02/MF A01 | DE83701952 | MN -34D | 8:39284 |
| **IFVE-ONF/FTO/PK-** | | | | |
| 150 | NTIS (US Sales Only), PC A03/MF A01 | DE83701953 | MN -34D | 8:39566 |
| **IFVE-OP-** | | | | |
| 81-166 | NTIS (US Sales Only), PC A02/MF A01 | DE83701905 | MN -34A | 8:39726 |
| **IFVE-OTF-** | | | | |
| 81-105 | NTIS (US Sales Only), PC A02/MF A01 | DE83701954 | MN -34D | 8:39567 |
| 81-140 | NTIS (US Sales Only), PC A02/MF A01 | DE83701851 | MN -34D | 8:39628 |
| 82-5 | NTIS (US Sales Only), PC A02/MF A01 | DE83701857 | MN -34D | 8:39743 |
| 82-18 | NTIS (US Sales Only), PC A02/MF A01 | DE83701855 | MN -34D | 8:39744 |
| 82-26 | NTIS (US Sales Only), PC A02/MF A01 | DE83701955 | MN -34D | 8:39568 |
| 82-43 | NTIS (US Sales Only), PC A02/MF A01 | DE83701956 | MN -34D | 8:39569 |
| 82-44 | NTIS (US Sales Only), PC A02/MF A01 | DE83701957 | MN -34D | 8:39570 |
| 82-45 | NTIS (US Sales Only), PC A02/MF A01 | DE83701856 | MN -34D | 8:39629 |
| 82-82 | NTIS (US Sales Only), PC A02/MF A01 | DE83701858 | MN -34D | 8:39745 |
| 82-90 | NTIS (US Sales Only), PC A02/MF A01 | DE83701958 | MN -34D | 8:39571 |
| 82-103 | NTIS (US Sales Only), PC A02/MF A01 | DE83701852 | MN -34D | 8:39615 |
| 82-111 | NTIS (US Sales Only), PC A02/MF A01 | DE83701853 | MN -34D | 8:39630 |
| 82-124 | NTIS (US Sales Only), PC A02/MF A01 | DE83701854 | MN -34D | 8:39746 |
| **IKE-** | | | | |
| 4-110 | NTIS (US Sales Only), PC A20/MF A01 | DE83751021 | MN -13 | 8:39386 |
| **INDC(CCP)-** | | | | |
| 177/ L | NTIS (US Sales Only), PC A04/MF A01 | DE83780702 | MN -34C | 8:39704 |
| **INDC(JAP)-** | | | | |
| 77/ G | *See* JAERI-M-83-041 | | ND -34C | 8:39655 |
| **INFN/BE-** | | | | |
| 82/ 2 | NTIS (US Sales Only), PC A02/MF A01 | DE83902399 | MN -34C | 8:39675 |

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| INFN/TC- | | | | |
| 82/ 10 | NTIS (US Sales Only), PC A02/MF A01; 1 | DE83902400 | MN -28 | 8:39289 |
| INIS-mf- | | | | |
| 8072 | NTIS (US Sales Only), PC A05/MF A01 | DE83780806 | MN -4 | 8:39221 |
| 8084 | NTIS (US Sales Only), PC A04/MF A01 | DE83780804 | MN -4 | 8:39222 |
| INP- | | | | |
| 1102/ C | NTIS (US Sales Only), PC A02/MF A01 | DE83702054 | MN -48 | 8:39443 |
| INR- | | | | |
| 1914 | Available from Energetics and Atomic Energy Information Centre, Warsaw, Poland | | ND -25 | 8:39097 |
| IPEN-Pub- | | | | |
| 42 | NTIS (US Sales Only), PC A02/MF A01 | DE83702037 | MN -4 | 8:39150 |
| 45 | NTIS (US Sales Only), PC A02/MF A01 | DE83702038 | MN -4 | 8:39161 |
| ISH- | | | | |
| 3 | Available from Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe (Germany, F.R.) | | | 8:39365 |
| ITEF- | | | | |
| 7(1982) | NTIS (US Sales Only), PC A02/MF A01 | DE83701991 | MN -34C | 8:39728 |
| 32(1982) | NTIS (US Sales Only), PC A03/MF A01 | DE83701998 | MN -34C | 8:39658 |
| 34(1982) | NTIS (US Sales Only), PC A03/MF A01 | DE83701946 | MN -34B | 8:39487 |
| 54(1982) | NTIS (US Sales Only), PC A03/MF A01 | DE83701932 | MN -20 | 8:39803 |
| 61(1982) | NTIS (US Sales Only), PC A02/MF A01 | DE83701933 | MN -20 | 8:39854 |
| 83(1982) | NTIS (US Sales Only), PC A02/MF A01 | DE83701860 | MN -34D | 8:39747 |
| 117(1981) | NTIS (US Sales Only), PC A02/MF A01 | DE83701906 | MN -34A | 8:39315 |
| 122(1981) | NTIS (US Sales Only), PC A02/MF A01 | DE83701986 | MN -34D | 8:39572 |
| 123(1981) | NTIS (US Sales Only), PC A02/MF A01 | DE83701896 | MN -34A | 8:39512 |
| 148(1981) | NTIS (US Sales Only), PC A03/MF A01 | DE83701859 | MN -34D | 8:39766 |
| 155(1981) | NTIS (US Sales Only), PC A03/MF A01 | DE83701945 | MN -34B | 8:39488 |
| ITEP- | | | | |
| 26(1982) | NTIS (US Sales Only), PC A03/MF A01 | DE83701959 | MN -34D | 8:39573 |
| 27(1982) | NTIS (US Sales Only), PC A02/MF A01 | DE83701960 | MN -34D | 8:39574 |
| 48(1982) | NTIS (US Sales Only), PC A02/MF A01 | DE83701861 | MN -34D | 8:39631 |
| ITF- | | | | |
| 82-20-R | NTIS (US Sales Only), PC A02/MF A01 | DE83701961 | MN -34D | 8:39575 |
| 82-57-R | NTIS (US Sales Only), PC A02/MF A01 | DE83701999 | MN -34C | 8:39713 |
| ITP- | | | | |
| 81-143-E | NTIS (US Sales Only), PC A02/MF A01 | DE83701962 | MN -34D | 8:39576 |
| JAERI-M- | | | | |
| 83-041 | Japan Atomic Energy Research Inst., Division of Technical Information, Tokai-mura, NaKa-gun, Ibaraki-Ken, Japan | | ND -34C | 8:39655 |
| 9523 | NTIS (US Sales Only), PC A11/MF A01 | DE83780670 | MN -80 | 8:38930 |
| JEN- | | | | |
| 517 | NTIS (US Sales Only), PC A11/MF A01 | DE83701692 | MN -46 | 8:39729 |
| 519 | NTIS (US Sales Only), PC A04/MF A01 | DE83701659 | MN -20 | 8:39804 |
| JINR- | | | | |
| 1-82-174 | NTIS (US Sales Only), PC A02/MF A01 | DE83701934 | MN -20 | 8:39660 |
| 1-82-235 | NTIS (US Sales Only), PC A02/MF A01 | DE83702023 | MN -34C | 8:39686 |
| 1-82-236 | NTIS (US Sales Only), PC A02/MF A01 | DE83701987 | MN -34D | 8:39536 |
| 1-82-388 | NTIS (US Sales Only), PC A02/MF A01 | DE83702024 | MN -34C | 8:39537 |
| 9-82-541 | NTIS (US Sales Only), PC A02/MF A01 | DE83701935 | MN -20 | 8:39527 |
| 14-81-841 | NTIS (US Sales Only), PC A02/MF A01 | DE83701907 | MN -34A | 8:39151 |
| E-2-82-36 | NTIS (US Sales Only), PC A02/MF A01 | DE83701964 | MN -34D | 8:39577 |
| E-2-82-195 | NTIS (US Sales Only), PC A02/MF A01 | DE83701963 | MN -34D | 8:39578 |
| E-2-82-277 | NTIS (US Sales Only), PC A02/MF A01 | DE83701862 | MN -34D | 8:39748 |
| E-2-82-316 | NTIS (US Sales Only), PC A02/MF A01 | DE83701863 | MN -34D | 8:39632 |
| E-2-82-427 | NTIS (US Sales Only), PC A02/MF A01 | DE83701864 | MN -34D | 8:39633 |
| E-2-82-441 | NTIS (US Sales Only), PC A02/MF A01 | DE83701865 | MN -34D | 8:39634 |
| E-2-82-442 | NTIS (US Sales Only), PC A02/MF A01 | DE83701866 | MN -34D | 8:39616 |
| E-2-82-506 | NTIS (US Sales Only), PC A02/MF A01 | DE83701867 | MN -34D | 8:39489 |
| E-2-82-542 | NTIS (US Sales Only), PC A02/MF A01 | DE83701965 | MN -34D | 8:39579 |
| E-4-82-269 | NTIS (US Sales Only), PC A02/MF A01 | DE83701868 | MN -34D | 8:39749 |
| E-4-82-586 | NTIS (US Sales Only), PC A02/MF A01 | DE83702000 | MN -34C | 8:39661 |
| E-14-82-461 | NTIS (US Sales Only), PC A02/MF A01 | DE83701908 | MN -34A | 8:39098 |
| R-3-82-309 | NTIS (US Sales Only), PC A02/MF A01 | DE83702005 | MN -34C | 8:39679 |
| R-4-82-30 | NTIS (US Sales Only), PC A02/MF A01 | DE83702008 | MN -34C | 8:39680 |
| R-4-82-85 | NTIS (US Sales Only), PC A02/MF A01 | DE83702010 | MN -34C | 8:39673 |
| R-4-82-183 | NTIS (US Sales Only), PC A02/MF A01 | DE83702006 | MN -34C | 8:39714 |
| R-4-82-257 | NTIS (US Sales Only), PC A02/MF A01 | DE83702007 | MN -34C | 8:39662 |
| R-4-82-358 | NTIS (US Sales Only), PC A02/MF A01 | DE83702009 | MN -34C | 8:39691 |
| R-7-82-29 | NTIS (US Sales Only), PC A02/MF A01 | DE83702011 | MN -34C | 8:39681 |
| JINR-D- | | | | |
| 1-82-447 | NTIS (US Sales Only), PC A02/MF A01 | DE83701988 | MN -34D | 8:39538 |
| 17-81-758 | NTIS (US Sales Only), PC A25/MF A01 | DE83780704 | MN -34 | 8:39751 |
| JINR-R- | | | | |
| 1-82-252 | NTIS (US Sales Only), PC A02/MF A01 | DE83701989 | MN -34D | 8:39541 |
| 1-82-333 | NTIS (US Sales Only), PC A02/MF A01 | DE83702025 | MN -34C | 8:39542 |
| 1-82-363 | NTIS (US Sales Only), PC A02/MF A01 | DE83702026 | MN -34C | 8:39543 |
| 2-81-833 | NTIS (US Sales Only), PC A02/MF A01 | DE83701966 | MN -34D | 8:39584 |
| 2-82-44 | NTIS (US Sales Only), PC A02/MF A01 | DE83701972 | MN -34D | 8:39585 |
| 2-82-50 | NTIS (US Sales Only), PC A02/MF A01 | DE83701973 | MN -34D | 8:39586 |
| 2-82-59 | NTIS (US Sales Only), PC A02/MF A01 | DE83701975 | MN -34D | 8:39587 |
| 2-82-114 | NTIS (US Sales Only), PC A02/MF A01 | DE83701870 | MN -34D | 8:39646 |
| 2-82-129 | NTIS (US Sales Only), PC A02/MF A01 | DE83701871 | MN -34D | 8:39647 |
| 2-82-151 | NTIS (US Sales Only), PC A02/MF A01 | DE83701872 | MN -34D | 8:39635 |
| 2-82-155 | NTIS (US Sales Only), PC A02/MF A01 | DE83701873 | MN -34D | 8:39752 |

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| 2-82-157 | NTIS (US Sales Only), PC A02/MF A01 | DE83701874 | MN -34D | 8:39648 |
| 2-82-163 | NTIS (US Sales Only), PC A02/MF A01 | DE83701875 | MN -34D | 8:39649 |
| 2-82-181 | NTIS (US Sales Only), PC A02/MF A01 | DE83701967 | MN -34D | 8:39588 |
| 2-82-185 | NTIS (US Sales Only), PC A02/MF A01 | DE83701876 | MN -34D | 8:39650 |
| 2-82-186 | NTIS (US Sales Only), PC A02/MF A01 | DE83701877 | MN -34D | 8:39753 |
| 2-82-248 | NTIS (US Sales Only), PC A02/MF A01 | DE83701878 | MN -34D | 8:39636 |
| 2-82-249 | NTIS (US Sales Only), PC A02/MF A01 | DE83701898 | MN -34A | 8:39513 |
| 2-82-260 | NTIS (US Sales Only), PC A02/MF A01 | DE83702001 | MN -34C | 8:39716 |
| 2-82-261 | NTIS (US Sales Only), PC A02/MF A01 | DE83702002 | MN -34C | 8:39717 |
| 2-82-262 | NTIS (US Sales Only), PC A02/MF A01 | DE83702003 | MN -34C | 8:39718 |
| 2-82-272 | NTIS (US Sales Only), PC A02/MF A01 | DE83701879 | MN -34D | 8:39651 |
| 2-82-274 | NTIS (US Sales Only), PC A02/MF A01 | DE83701968 | MN -34D | 8:39589 |
| 2-82-296 | NTIS (US Sales Only), PC A02/MF A01 | DE83701880 | MN -34D | 8:39754 |
| 2-82-323 | NTIS (US Sales Only), PC A02/MF A01 | DE83702028 | MN -34C | 8:39590 |
| 2-82-327 | NTIS (US Sales Only), PC A02/MF A01 | DE83701969 | MN -34D | 8:39591 |
| 2-82-330 | NTIS (US Sales Only), PC A02/MF A01 | DE83701881 | MN -34D | 8:39755 |
| 2-82-337 | NTIS (US Sales Only), PC A03/MF A01 | DE83701882 | MN -34D | 8:39637 |
| 2-82-338 | NTIS (US Sales Only), PC A02/MF A01 | DE83701970 | MN -34D | 8:39592 |
| 2-82-345 | NTIS (US Sales Only), PC A02/MF A01 | DE83701883 | MN -34D | 8:39617 |
| 2-82-356 | NTIS (US Sales Only), PC A02/MF A01 | DE83701971 | MN -34D | 8:39593 |
| 2-82-376 | NTIS (US Sales Only), PC A02/MF A01 | DE83701884 | MN -34D | 8:39638 |
| 2-82-404 | NTIS (US Sales Only), PC A02/MF A01 | DE83701885 | MN -34D | 8:39756 |
| 2-82-560 | NTIS (US Sales Only), PC A02/MF A01 | DE83701974 | MN -34D | 8:39594 |
| 3-81-843 | NTIS (US Sales Only), PC A02/MF A01 | DE83701911 | MN -34A | 8:39099 |
| 3-82-305 | NTIS (US Sales Only), PC A02/MF A01 | DE83702004 | MN -34C | 8:39682 |
| 4-82-229 | NTIS (US Sales Only), PC A02/MF A01 | DE83701912 | MN -34A | 8:39514 |
| 4-82-410 | NTIS (US Sales Only), PC A02/MF A01 | DE83701899 | MN -34A | 8:39515 |
| 4-82-418 | NTIS (US Sales Only), PC A02/MF A01 | DE83701900 | MN -34A | 8:39516 |
| 5-82-193 | NTIS (US Sales Only), PC A02/MF A01 | DE83701886 | MN -34D | 8:39757 |
| 5-82-239 | NTIS (US Sales Only), PC A02/MF A01 | DE83701887 | MN -34D | 8:39652 |
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| 159 | Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R. | | | 8:39285 |
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| 1982-64 | NTIS (US Sales Only), PC A02/MF A01 | DE83701651 | MN -34A | 8:39137 |
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| 1982-73 | NTIS (US Sales Only), PC A02/MF A01 | DE83701652 | MN -34A | 8:39104 |
| 1982-74 | NTIS (US Sales Only), PC A02/MF A01 | DE83701641 | MN -34D | 8:39640 |
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| 82-6 | NTIS (US Sales Only), PC A02/MF A01 | DE83701976 | MN -34D | 8:39599 |
| 82-9 | NTIS (US Sales Only), PC A02/MF A01 | DE83702013 | MN -34C | 8:39719 |
| 82-11 | NTIS (US Sales Only), PC A03/MF A01 | DE83701913 | MN -34A | 8:39731 |
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| 81-2 | NTIS (US Sales Only), PC A02/MF A01 | DE83701901 | MN -34A | 8:39518 |
| 81-7 | NTIS (US Sales Only), PC A02/MF A01 | DE83702015 | MN -34C | 8:39670 |
| 81-9 | NTIS (US Sales Only), PC A04/MF A01 | DE83780698 | MN -37 | 8:39138 |
| 81-19 | NTIS (US Sales Only), PC A02/MF A01 | DE83702033 | MN -34C | 8:39689 |
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| 9611 | NTIS, PC A02/MF A01 | DE83013327 | STD -10 | 8:38490 |
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| 2-69-3302 | New Mexico Energy Research and Development Inst., 117 Richmond Dr. N.E., Albuquerque, NM 87106 | | MN -92a | 8:38448 |
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| 3902113 | Rutgers The State Univ. of New Jersey, Graduate School of Library and Information Studies, 4 Huntington St., New Brunswick, NJ 08903 | | ND -13 | 8:39906 |

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| 3902381 | OECD Publications and Information Center, Suite 1207, 1750 Pennsylvania Ave., NW, Washington, DC 20006 | | ND -78 | 8:38935 |
| 3902384 | OECD Publications and Information Center, Suite 1207, 1750 Pennsylvania Ave., NW, Washington, DC 20006 | | ND -78 | 8:38951 |
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| 0831-Suppl.4 | NTIS, PC A08/MF A01 - GPO $5.50 | DE83902367 | MN -78 | 8:38953 |
| 0882-Suppl.1 | NTIS, PC A02/MF A01 - GPO $3.00 | DE83902380 | MN -80 | 8:38954 |
| 0910-Rev.1 | NTIS, PC A10/MF A01 - GPO $7.00 | DE83902261 | MN -2 | 8:38923 |
| 0939 | NTIS, PC A03/MF A01; 1 - GPO $3.50 | DE83902242 | MN -78 | 8:38900 |
| 0974 | NTIS, PC A15/MF A01; 1 - GPO | DE83902556 | MN -80 | 8:38937 |
| 0986 | NTIS, PC A05/MF A01 - GPO $4.75 | DE83902555 | MN -78 | 8:38912 |
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| 0051-Vol.4-No.7 | NTIS, PC A03/MF A01 - GPO | DE83902245 | MN -13 | 8:38924 |
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| 0200-Vols.1-2-3 | NTIS, PC A04/MF A01 | DE83013779 | MN -80 | 8:38932 |
| 2331-Vol.2-No.4 | NTIS, PC A08/MF A01; 1 - GPO | DE83013838 | MN -80 | 8:38955 |
| 2607 | NTIS, PC A06/MF A01 - GPO | DE83013475 | MN -78 | 8:38956 |
| 2770 | NTIS, PC A08/MF A01 - GPO $6.50 | DE83008729 | MN -80 | 8:38901 |
| 2786 | NTIS, PC A04/MF A01 - GPO $4.50 | DE83902098 | MN -78 | 8:38957 |
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| 3133 | NTIS, PC A02/MF A01 - GPO | DE83013269 | MN -11 | 8:39444 |
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| 209-Rev.3 | NTIS, PC A05/MF A01; 1 | DE83012962 | MN -2 | 8:39334 |
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| 81-18 | NTIS, PC A06/MF A01; 1 | DE83013034 | MN -91 | 8:38468 |
| 82-36 | *See* PB-83-201020 | | MN -90c | 8:38360 |
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| 2528 | NTIS (US Sales Only), PC A02/MF A01; 1 | DE83901766 | MN -97a | 8:39277 |
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| 190(3) | NTIS, PC A03/MF A01 | DE83013111 | MN -70 | 8:39471 |
| 237 | NTIS, PC A03/MF A01 | DE83013906 | MN -70 | 8:39472 |
| 250 | NTIS, PC A10/MF A01 | DE83012965 | MN -70 | 8:39473 |
| 430 | NTIS (US Sales Only), PC A10/MF A01; 1 | DE83013905 | MN -70 | 8:39474 |
| 462 | NTIS, PC A03/MF A01 | DE83013814 | MN -70 | 8:38538 |
| 464 | NTIS, PC A03/MF A01 | DE83013902 | MN -70 | 8:38539 |
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| **ORNL-** | | | | |
| 5955 | NTIS, PC A11/MF A01; 1 | DE83013129 | STD -90d | 8:38336 |
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| **ORNL/CON-** | | | | |
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| 124 | NTIS, PC A07/MF A01 | DE83013734 | MN -95d | 8:39050 |
| **ORNL/CSD-** | | | | |
| 111 | NTIS, PC A03/MF A01 | DE83013726 | MN -32 | 8:39407 |
| 119 | NTIS, PC A02/MF A01 | DE83013739 | STD -32 | 8:39896 |
| **ORNL/ENG/TM-** | | | | |
| 5/ Rev.1 | NTIS, PC A06/MF A01; 1 | DE83013737 | STD -71 | 8:39239 |
| **ORNL/MIT-** | | | | |
| 362 | NTIS, PC A03/MF A01 | DE83013714 | MN -90d | 8:38588 |
| **ORNL/NUREG/CSD-** | | | | |
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| **ORNL/PPA-** | | | | |
| 83/ 7 | NTIS, PC A03/MF A01 | DE83013789 | MN -88 | 8:38398 |
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| 8656 | NTIS, PC A02/MF A01 | DE83013731 | MN -37 | 8:39154 |
| 8731 | NTIS, PC A03/MF A01 | DE83013727 | STD -86 | 8:38503 |
| 8735 | NTIS, PC A03/MF A01 | DE83013715 | MN -90 | 8:38424 |
| 8769 | NTIS, PC A03/MF A01 | DE83013736 | MN -34C | 8:39722 |
| 8772 | NTIS, PC A02/MF A01 | DE83013730 | MN -80 | 8:38943 |
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| 83-169789 | NTIS, PC AE07/MF E07 | | | 8:38541 |
| 83-169995 | NTIS, PC A03/MF A01 | | | 8:39376 |
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| 83-171801 | NTIS, PC A03/MF A01 | | | 8:38472 |
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| 4429 | NTIS, PC A06/MF A01; 1 | DE83013743 | MN -60 | 8:38855 |
| 4529 | NTIS, PC A08/MF A01 | DE83013283 | MN -95f | 8:39060 |
| 4560 | NTIS, PC A02/MF A01 | DE83013851 | MN -41 | 8:39435 |
| 4563 | *See* NUREG/CR-3087 | DE83012978 | MN -70B | 8:38537 |
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| 4685 | NTIS, PC A04/MF A01; 1 | DE83013850 | MN -80 | 8:38902 |
| 4688 | NTIS, PC A07/MF A01 | DE83013909 | MN -70 | 8:38569 |
| 4743 | NTIS, PC A04/MF A01 | DE83013908 | MN -94e | 8:38973 |
| 4744 | NTIS, PC A03/MF A01 | DE83013904 | MN -70 | 8:38545 |
| 4745 | NTIS, PC A08/MF A01; 1 | DE83012963 | MN -59 | 8:38764 |
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| 10353 | NTIS, PC A02/MF A01 | DE83013758 | MN -85 | 8:38510 |

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| 10694 | NTIS, PC A02/MF A01 | DE83013260 | MN -70 | 8:38546 |
| 10712 | NTIS, PC A02/MF A01 | DE83013368 | MN -70 | 8:38547 |
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| 10994 | NTIS, PC A02/MF A01; 1 | DE83013836 | MN -60 | 8:38863 |
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| 11075 | NTIS, PC A02/MF A01 | DE83013756 | MN -80 | 8:38962 |
| 11135 | NTIS, PC A02/MF A01 | DE83013250 | MN -71 | 8:38511 |
| 11155 | NTIS, PC A04/MF A01 | DE83011830 | MN -41 | 8:39451 |
| 11172 | NTIS, PC A02/MF A01; 1 | DE83013823 | MN -60 | 8:38865 |
| 11277 | NTIS, PC A02/MF A01 | DE83012796 | MN -41 | 8:38963 |
| 11303 | NTIS, PC A03/MF A01 | DE83012605 | MN -48 | 8:39396 |
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| 11346 | NTIS, PC A03/MF A01 | DE83011380 | MN -69 | 8:39446 |
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| 11379 | NTIS, PC A02/MF A01 | DE83013257 | MN -70B | 8:38549 |
| 11393 | NTIS, PC A02/MF A01 | DE83013261 | MN -25 | 8:39121 |
| 11423 | NTIS, PC A02/MF A01 | DE83013825 | MN -11 | 8:39367 |
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| 2010 | NTIS, PC A03/MF A01 | DE83013722 | STD -20f | 8:39814 |
| 2012 | NTIS, PC A02/MF A01 | DE83013720 | STD -20f | 8:39815 |
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| 3455 | NTIS, PC A02/MF A01 | DE83010361 | STD -25 | 8:39107 |
| 3519 | NTIS, PC A02/MF A01 | DE83013683 | MN -32 | 8:39897 |
| 03388 | NTIS, PC A02/MF A01; 1 | DE83013611 | MN -25 | 8:39108 |
| **RFP-ABST-** | | | | |
| 06 | NTIS, PC A02/MF A01 | DE83013879 | MN -4 | 8:39178 |
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| 262P | NTIS, PC A02/MF A01 | DE83013812 | MN -70 | 8:39475 |
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| 289-P | NTIS, PC A02/MF A01; 1 | DE83013478 | MN -70 | 8:39458 |
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| 155-P | NTIS, PC A03/MF A01; 1 | DE83013943 | MN -70 | 8:38563 |
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| 20110-9 | NTIS, PC A02/MF A01; 1 | DE83011834 | MN -59c | 8:38807 |
| **SAND-** | | | | |
| 79-2198 | NTIS, PC A02/MF A01 | DE83013645 | MN -2 | 8:39318 |
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| 82-0431 | *See* NUREG/CR-2607 | DE83013475 | MN -78 | 8:38956 |
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| 82-1877C | NTIS, PC A03/MF A01; 1 | DE83012635 | MN -38 | 8:39320 |
| 82-1911 | *See* GA-A-17121 | DE83013682 | MN -71 | 8:38507 |
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| 82-1928C | NTIS, PC A02/MF A01; 1 | DE83013766 | MN -71 | 8:38513 |
| 82-1947C | NTIS, PC A02/MF A01; 1 | DE83013773 | MN -71 | 8:38514 |
| 82-1991C | NTIS, PC A02/MF A01; 1 | DE83013630 | MN -71 | 8:39241 |
| 82-1992C | NTIS, PC A02/MF A01 | DE83013631 | MN -71 | 8:38515 |
| 82-1994C | NTIS, PC A02/MF A01; 1 | DE83013471 | MN -71 | 8:39242 |
| 82-1995C | NTIS, PC A02/MF A01 | DE83013669 | MN -71 | 8:38516 |
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| 82-1997C | NTIS, PC A02/MF A01 | DE83013684 | MN -71 | 8:38518 |
| 82-2186 | NTIS, PC A09/MF A01; 1 | DE83013524 | MN -11 | 8:39269 |
| 82-2193 | NTIS, PC A02/MF A01: 1 | DE83013525 | MN -11 | 8:39338 |
| 82-2363 | NTIS, PC A06/MF A01; 1 | DE83013531 | MN -90h | 8:38361 |
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| 82-2732C | NTIS, PC A02/MF A01 | DE83013633 | MN -21 | 8:39865 |
| 83-0019C | NTIS, PC A02/MF A01; 1 | DE83012630 | MN -21 | 8:39866 |
| 83-0046C | NTIS, PC A02/MF A01; 1 | DE83013677 | MN -38 | 8:39243 |
| 83-0108C | NTIS, PC A02/MF A01 | DE83013641 | MN -21 | 8:39867 |
| 83-0121C | NTIS, PC A02/MF A01; 1 | DE83013643 | MN -38 | 8:39244 |
| 83-0139C | NTIS, PC A03/MF A01 | DE83013307 | MN -34 | 8:39732 |
| 83-0196C | NTIS, PC A02/MF A01 | DE83013670 | MN -71 | 8:38519 |
| 83-0197 | NTIS, PC A06/MF A01; 1 | DE83014359 | MN -37 | 8:39321 |
| 83-0219C | NTIS MF A01; 2 | DE83012873 | MN -35 | 8:39016 |
| 83-0228C | NTIS, PC A02/MF A01; 1 | DE83013769 | MN -38 | 8:39245 |
| 83-0229 | NTIS, PC A02/MF A01; 1 | DE83011795 | MN -32 | 8:39898 |
| 83-0238 | NTIS, PC A03/MF A01; 1 | DE83013529 | MN -66c | 8:38819 |
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| 83-0333C | NTIS, PC A02/MF A01 | DE83013675 | MN -38 | 8:39246 |
| 83-0351C | NTIS, PC A02/MF A01; 1 | DE83011784 | MN -21 | 8:39870 |
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| 83-0516 | NTIS, PC A04/MF A01; 1 | DE83012968 | MN -70 | 8:38552 |
| 83-0544C | NTIS, PC A02/MF A01; 1 | DE83012871 | MN -21 | 8:39871 |
| 83-0630 | NTIS, PC A03/MF A01 | DE83013530 | MN -92 | 8:38462 |
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| 83-1000C | NTIS, PC A02/MF A01; 1 | DE83013466 | MN -21 | 8:39872 |
| 83-1007C | NTIS, PC A02/MF A01; 1 | DE83012494 | MN -21 | 8:39873 |
| 83-1016C | NTIS, PC A02/MF A01 | DE83012636 | MN -21 | 8:39874 |
| 83-1078 | NTIS, PC A03/MF A01; 1 | DE83013959 | STD -92 | 8:38464 |
| 83-1147C | NTIS, PC A02/MF A01; 1 | DE83013097 | MN -35 | 8:39333 |
| 83-1176C | NTIS, PC A02/MF A01 | DE83012322 | MN -13 | 8:39335 |
| 83-1194C | NTIS, PC A02/MF A01 | DE83013309 | MN -34 | 8:39139 |
| 83-1210C | NTIS, PC A02/MF A01 | DE83012495 | MN -63 | 8:38658 |
| 83-1218C | NTIS, PC A02/MF A01 | DE83012870 | MN -25 | 8:39109 |
| 83-1260C | NTIS, PC A02/MF A01; 1 | DE83012628 | MN -38 | 8:39122 |
| 83-1279C | NTIS, PC A02/MF A01 | DE83013311 | MN -34 | 8:39140 |
| 83-1308C | NTIS, PC A02/MF A01 | DE83013465 | MN -38 | 8:39272 |
| 83-1314C | NTIS, PC A02/MF A01; 1 | DE83013265 | MN -4 | 8:39192 |
| 83-1341C | NTIS, PC A02/MF A01 | DE83013640 | MN -20g | 8:39816 |
| 83-1993C | NTIS MF A01; 2 | DE83013264 | MN -71 | 8:39248 |
| 83-8021 | NTIS, PC A03/MF A01; 1 | DE83013903 | MN -62c | 8:38765 |
| 83-8216 | NTIS, PC A09/MF A01; 1 | DE83013622 | MN -62c | 8:38766 |
| 83-8217 | NTIS, PC A02/MF A01 | DE83013623 | MN -62d | 8:38767 |
| 83-8224 | NTIS, PC A03/MF A01 | DE83013282 | MN -62d | 8:38768 |
| 83-8227 | NTIS, PC A03/MF A01 | DE83013268 | MN -13 | 8:39899 |
| 83-8229 | NTIS, PC A05/MF A01 | DE83013281 | MN -13 | 8:39265 |
| 83-8232 | NTIS, PC A04/MF A01; 1 | DE83013864 | MN -37 | 8:39322 |
| 1304C | NTIS, PC A02/MF A01; 1 | DE83013671 | MN -32 | 8:39900 |
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| 211-1959 | NTIS, PC A02/MF A01; 1 | DE83011957 | STD -63 | 8:38686 |
| 211-1960 | NTIS, PC A02/MF A01 | DE83011956 | STD -60 | 8:38769 |
| 211-1978 | NTIS, PC A02/MF A01; 1 | DE83011963 | STD -60 | 8:38867 |
| 211-1984 | NTIS MF A01; 2 | DE83011960 | STD -60 | 8:38868 |
| 211-1990 | NTIS, PC A02/MF A01; 1 | DE83011958 | STD -63 | 8:38687 |
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| 8041-6-T1 | NTIS, PC A07/MF A01; 1 | DE83008485 | STD -63 | 8:38688 |
| 8119-2-T5 | NTIS, PC A06/MF A01 | DE83013498 | STD -63e | 8:38689 |
| SLAC-PUB-3118 | NTIS, PC A02/MF A01 | DE83012376 | MN -34D | 8:39547 |
| SLAC-PUB-3023 | NTIS MF A01; 2 | DE83012953 | MN -62 | 8:38811 |
| 3072 | NTIS, PC A02/MF A01 | DE83013126 | MN -28 | 8:39291 |
| 3075 | NTIS, PC A02/MF A01 | DE83013108 | MN -28 | 8:39742 |
| 3078 | NTIS, PC A02/MF A01; 1 | DE83013106 | MN -28 | 8:39292 |
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| D | Thesis or dissertation |
| TG | Translation (general) |
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| EG | Egypt |
| ER | European Space Research Organization |
| ES | Spain |
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| GB | United Kingdom of Great Britain and Northern Ireland (UK) |
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| IA | Inter-American Nuclear Energy Commission |
| IB | International Bank for Reconstruction and Development |
| ID | Indonesia |
| IE | Ireland |
| IG | Inter-Governmental Maritime Consultative Organization |
| II | International Commission on Radiation Units and Measurements |
| IL | Israel |

IN India
IO International Labor Organization
IP International Union of Pure and Applied Physics
IQ Iraq
IR Iran
IS Iceland
IT Italy
IX International Union of Pure and Applied Chemistry

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JO Jordan
JP Japan

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KH Cambodia
KP Democratic People's Republic of Korea
KR Korea, Republic of
KW Kuwait

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OM Oman

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PG Papua New Guinea
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SY Syria
SZ Swaziland

TC Trucial Oman
TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UE United Nations Educational, Scientific and Cultural Organization
UF United Nations Children's Fund
UG Uganda
UI United Nations Industrial Development Organization
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Viet-Nam
VE Venezuela
VS Republic of Viet-Nam

WM World Meteorological Organization
WS Western Samoa

XA International Atomic Energy Agency (IAEA)
XC European Organization for Nuclear Research (CERN)
XE Commission of the European Communities (CEC)
XF Food and Agriculture Organization of the United Nations (FAO)
XJ Joint Institute for Nuclear Research (JINR)
XM Council for Mutual Economic Assistance (CMEA)
XN Nuclear Energy Agency of the OECD (NEA)
XO Organization of African Unity (OAU)
XR International Commission on Radiological Protection (ICRP)
XS International Organization for Standardization (ISO)
XU United Nations (UN)
XW World Health Organization (WHO)
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YD Democratic Yemen
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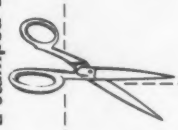

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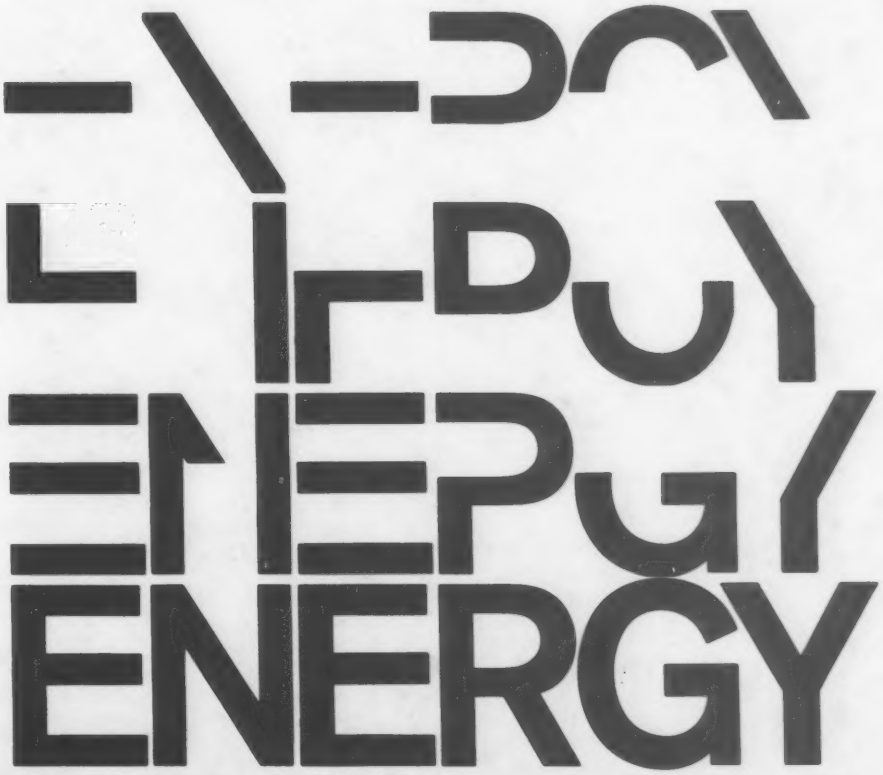

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